

VOLUME 1 NUMBER 4 APRIL 1994

OS/2

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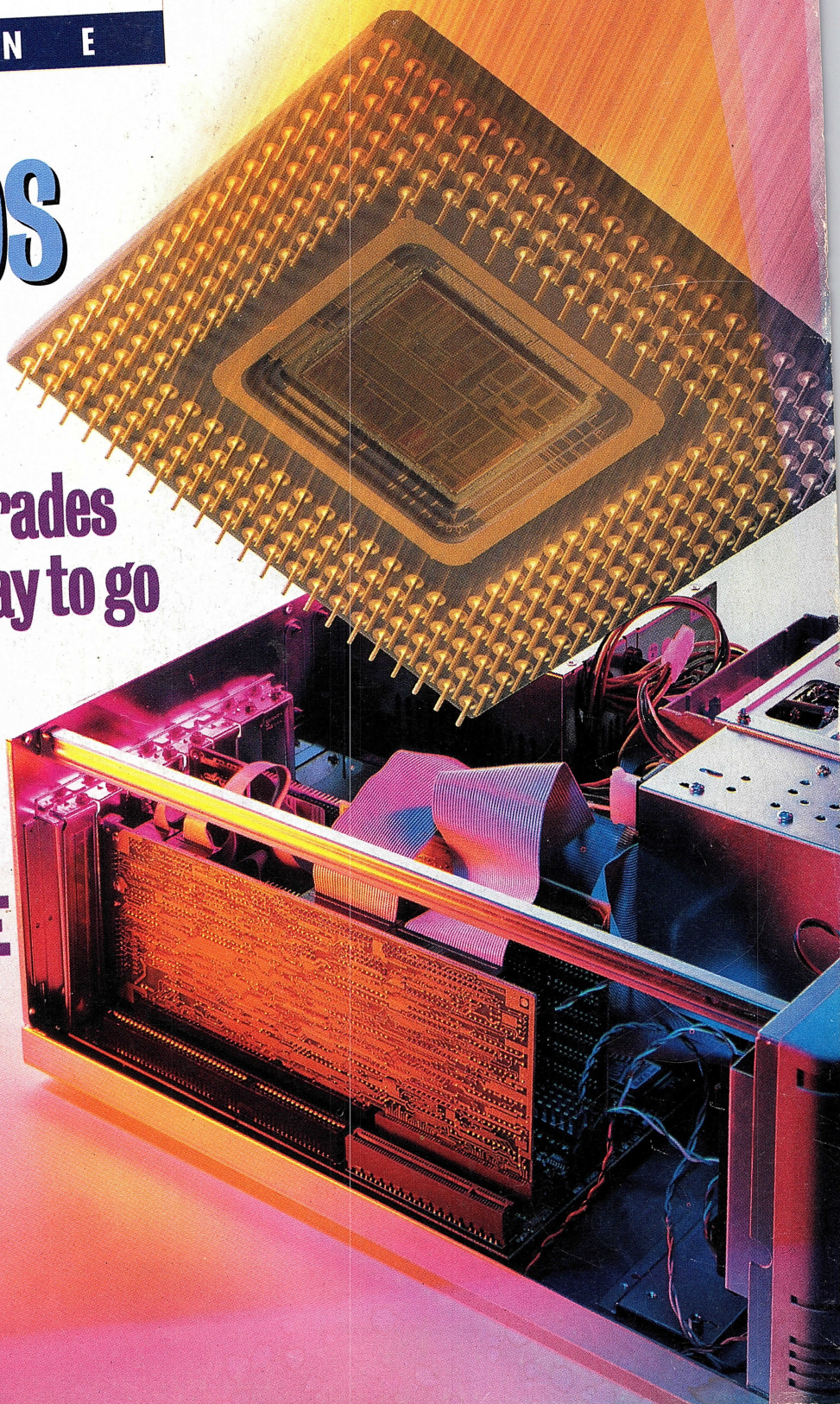
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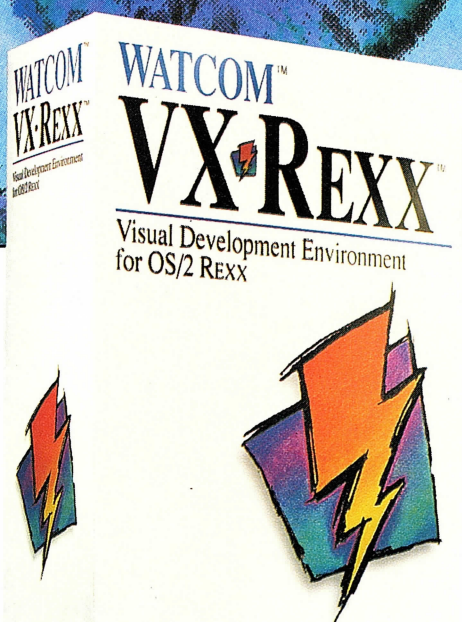
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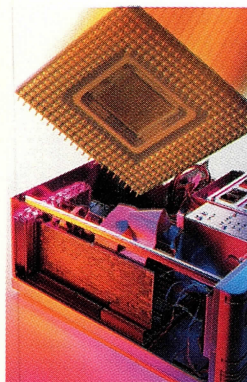
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April 1994



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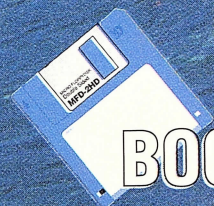
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Perspectives

Learning from Apple

If OS/2 is the most powerful operating system for Intel-based microcomputers, why isn't it the easiest to learn and use? As someone who's taught new DOS, Windows, and Macintosh users, I'll agree that for the novice, OS/2 2.1's Workplace Shell is good—but could stand improvement. When it comes to simple "up-and-running" power, Apple's Macintosh System 7 is better. (Of course, System 7 isn't a preemptive multitasking operating system—but it's the user interface I'm talking about.)

Wait a second! Before you OS/2 zealots reach for your shotguns, I share your belief that the OS/2 2.1 Workplace Shell is a darn sight better interface than DOS or Windows. Still, there are still aspects of OS/2, and of the WPS, that trail behind the Macintosh's System 7 interface and structure. So, why can't Apple and IBM, who are already collaborating on Taligent's future operating systems and on designing Macintosh computers based on the PowerPC chip, share some of their user-interface know-how in OS/2 2.2 or OS/2 2.3?

For example: Why are OS/2 users still putting up with *config.sys*? There are two uses for *config.sys*. The first is to specify which device drivers should be loaded upon startup. Why not create a default system directory, *C:\drivers*, into which device drivers (or their shadows) can be copied by the user or by software installation routines? (This would be roughly analogous to the Macintosh's Control Panels or Extensions folders.) With a *c:\drivers* system, we could get rid of page after page of *DEVICE=* statements in a very straightforward and user-friendly fashion.

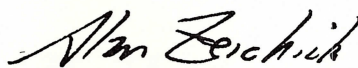
The second purpose of *config.sys* is to specify parameters for device drivers and system utilities, *PRINTMONBUFSIZE=134,134,134* being a good example. But isn't that what system settings notebooks were designed for? (The settings notebooks are one place where Apple could learn from the OS/2 development team.) IBM had a great idea here, but they fail to carry the paradigm through to its logical conclusion.

Installation of fonts and sounds should be just as simple. Why not drag or copy them into the appropriate *c:\fonts* or *c:\sounds* directory, and make OS/2 reconfigure itself automatically? After all, if the user's intentions are unambiguous, an operating system should be able to take care of the housekeeping details.

And how about the Shredder, that poor excuse for a file-deletion tool? The Macintosh's file-deletion procedure is simple: If you delete a file, it goes into the trash can. If you want to see what you've recently deleted, simply open up the trash can as if it were a folder and drag out anything that doesn't belong there. When you're ready to free up disk space, empty the trash. C'mon, IBM, license that tool (if necessary) from Apple, and make the undeletion tool work automatically with *all* deleted files, including those nuked from DOS or Windows sessions.

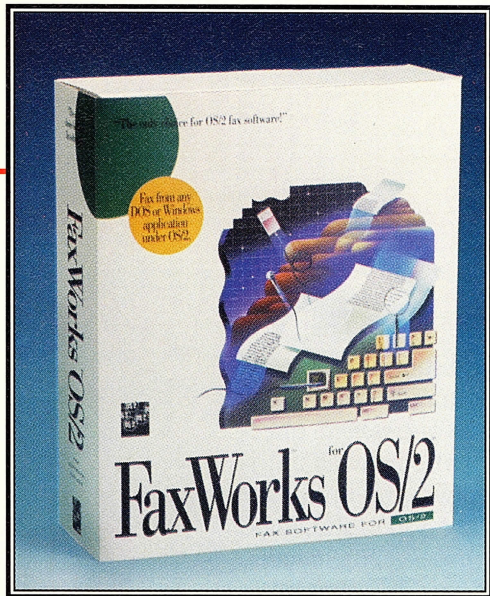
Okay, here's another suggestion: If formatting a DOS or OS/2 floppy prompts us for volume names, why can't we use those names? On the Macintosh, file opening/saving and drag-and-drop goes to *disks*, not to *drives*. Under OS/2, I copy a file to Drive B:. On the Macintosh, I copy the file to "Take-Home Work." Especially when you figure in the impossible-to-remember drive letters of network volumes, you'd think that users—advanced and novice alike—would like to use meaningful volume names rather than a naming convention left over from IBM mainframes and CP/M.

So, IBM: I've heard from your designers that the Workplace OS will have the "ultimate user interface." I'm looking forward to seeing it. But now's your opportunity to do away with those old DOS legacy *config.sys*, *autoexec.bat* and *c:* relics.



Alan Zeichick
Editor in chief





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Letters

"Am I correct in assuming there was no January issue?"

Dear Editor:

I just received the February 1994 issue of *OS/2 Magazine* today. Am I correct in assuming there was no January 1994 issue of the magazine, and that I am up-to-date?

Michael L. Gerke
Romulus, Mich.

You are right. Our plan for OS/2 Magazine was to publish the December 1993 Premiere issue, and then begin regular monthly publication with the February 1994 issue. We didn't want to publish a second issue until the editors and writers had a chance to hear comments on the first issue.

-Editor

Dear Editor:

In timing tests of OS/2 versus DOS I discovered an interesting circumstance concerning OS/2's manner of managing memory. One of my tests measured the time taken to invert a 50x50 matrix. Under DOS 6.0 it took 48 seconds, and under OS/2 2.1 it took 30 seconds. The algorithms used were compiled to be native to the operating system (however, the OS/2 compilation was for version 1.3. using Microsoft's BASIC Professional Development System 7.1 compiler).

I have since found that the very same object code running under OS/2 performed the matrix inversion in 11 seconds, and sometimes in 60 seconds. I called IBM OS/2 support to find out why. (They were very cooperative and spent a lot of time with me, but couldn't give me a specific answer.) The execution time for the program was consistently either 11, 30, or 60 seconds. For the 60-second runs OS/2 was using the *swapper.dat* file. For the 11- and 30-second runs, it was not. Since I have 16MB of RAM, it was not clear why the *swapper.dat* file would ever be used.

I realized that OS/2 manages memory in a way that does not necessarily release RAM resources (or at least does not release them right away) after a program has terminated. Repeated runs of the same application might become slower as memory management becomes more complicated. IBM said that some compilers (such as their C++) provide a way to "reinitialize" memory to avoid this problem when the program executes. If my (four year old) BASIC compiler does, I don't know about it.

George M. Lady
Mount Holly, N.J.

Dear Editor:

It appears that most of your editorial staff frequents the CompuServe information system. I would encourage you to establish a presence on other major information systems. Specifically, I would recommend that you participate in the established OS/2 conferences on FidoNet, the IBM OS/2 BBS (TalkLink), the Internet, and Prodigy. The large community of on-line OS/2 users would become more familiar with *OS/2 Magazine*, and it would help your staff to get in touch with a much broader group of OS/2 users who cannot necessarily afford to access CompuServe.

Wayne Holmes
Seattle, Wash.

The OS/2 Magazine editors, and most of our regular writers and columnists, frequent the various OS/2-specific forums on CompuServe, notably OS2USER and OS2AVEN (where we maintain a regular presence and distribute files about the magazine).

Many of our editors and writers regularly log into and participate in OS/2 discussions on other on-line services and bulletin-boards. Our editors can be reached by anyone with

Internet e-mail access, using the addresses on page 4.

-Editor

Dear Editor:

In his column in the February issue (*OS/2 Magazine*, February, p. 83), David Reich said that people will have to buy the OS/2 Developer's Tool kit to create on-line books. That's incorrect, IBM has two products called Book Manager Read (Part #5601454) that sells for \$203, and Book Manager Build (Part #53G4085) for \$895 that is capable of creating on-line books. Both can be ordered directly from IBM by calling (800) 426-2255.

Gene Wilson
San Diego, Calif.

Not every OS/2 user has an on-line reader that can read Book Manager documents, whereas every OS/2 owner has view.exe included in their system.

-David Reich

Errata

The phone number for Right-ware listed in the Just Announced section (*OS/2 Magazine*, Premiere, p. 73) was incorrect. The correct phone number is (301) 762-1151.

The contact information for North Shore Systems was listed incorrectly in the February issue, p. 65. The correct phone number is (702) 831-1108 and the correct fax number is (702) 831-8553.

The price listed for Multi-Net Communications' Pmcomm 2.11 in the Just Announced section of the February issue, p. 63 was incorrect. The actual price of the product is \$99.95.

OS/2 Magazine welcomes letters from readers. Please mail to OS/2 Magazine, 600 Harrison Street, San Francisco, CA 94107, or via E-mail at CompuServe 71154.676 or Internet os2mag@mfi.com.

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New Releases

NEW OPERATING SYSTEMS, VIDEO AND MORE BY ALEXANDER ANTONIADES

OS/2 2.2?

IBM Personal System Products' point man, David Barnes, and his OS/2 road show rolled into the Vancouver PC Users Society, where he was to debate with a representative of Microsoft Corp. on the future of 32-bit operating systems. At the last minute, Microsoft withdrew, claiming that regional sales meetings prevented any of their marketing personnel from attending the evening event held two-and-a-half hours north of company headquarters in Redmond, Wash.

Making use of the extra time given him, Barnes hinted at what we might expect from future releases of OS/2. He said design objectives for the next version of OS/2 (also referred to as the "laptop build") have focused on building a good strong code base to make it run faster. This optimized version of OS/2 will trim the amount of RAM needed by at least 2MB. According to Barnes, this means OS/2 will be usable on a 4MB machine, and will perform well on a 6MB machine.

Other IBM officials have offered more information about the upcoming release. The single-threaded 16-bit boot loader responsible for OS/2's slow boot time will be replaced by a multithreaded 32-bit boot loader to significantly improve startup time. Other features

**This
optimized
version of OS/2 will
trim the amount of
RAM needed by at
least 2MB**

of interest include a dashboard type of controller, which will allow quick access to frequently used application icons and password security for protecting selected programs.

Support for Win32s is now ready to be included with Win-OS/2 in an upcoming release. Win32s is Microsoft's first subset of their Win32 API on which Windows NT is built. Support for Win32s will become increasingly important for maintaining Win-OS/2 compatibility with the next generation of Windows applications.

It is still unknown which of these features will be included in new versions of OS/2 and which will be made available as separate add-ons, such as Communication Manager/2. IBM officials have hinted that there may be an announcement of updates to

OS/2 at Spring COMDEX, May 23-26, in Atlanta, Ga.

IBM releases Video IN/2 extension for OS/2

IBM's decision to include their Ultimotion software and Intel's Indeo drivers with OS/2 2.1 demonstrated IBM's commitment to multimedia, however, until now there didn't seem to be a way to easily make use of these tools under OS/2. One reason for this was that there was no way to capture and edit full-motion video under OS/2 because most of the video-capture boards only had Windows drivers. At Fall COMDEX in Las Vegas, Nev., IBM let the other shoe drop and announced the release of Ultimedia Video IN/2, a video-capture software utility.

Video IN/2 works with a video-capture board to take video images and turn them into files that can be played back through the Multimedia Extensions to Presentation Manager/2 (MMPM/2) digital-video device, which is included in every OS/2 package. Even though .avi files can be played back on any machine running OS/2, a 486 or greater is recommended for a sufficient frame rate, and a sound card is still required for any audio output from .avi files.

Video IN/2's capture support extends to the following video-capture boards: IBM Video Capture

Adapter/A (MCA); Jovian Logic SuperVia and QuickVia (MCA and ISA); Sigma Designs WinMovie (ISA); Creative Labs Video Blaster (ISA); New Media Graphics Super Video Windows (MCA and ISA); and Samsung Electronics Ltd. Video Magic (ISA). The Pioneer laser disc models 4200, 4300D (NTSC and PAL),

4400, and 8000 are also supported for asymmetric capture.

The Video IN/2 package comes with a video recorder/editor, an .avi file utility, a video developer's kit, the video-capture device drivers, and special video adapters. Ultimedia Video IN/2 is available for \$199 directly from IBM or through retail channels.

For more information, contact IBM at (800) 342-6672 or the Ultimedia Tool Series at (800) 887-7771 or (415) 988-0741.

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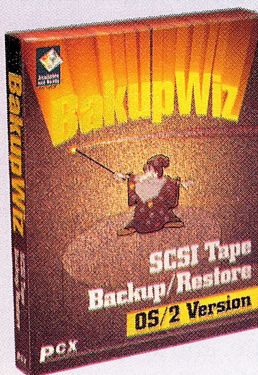


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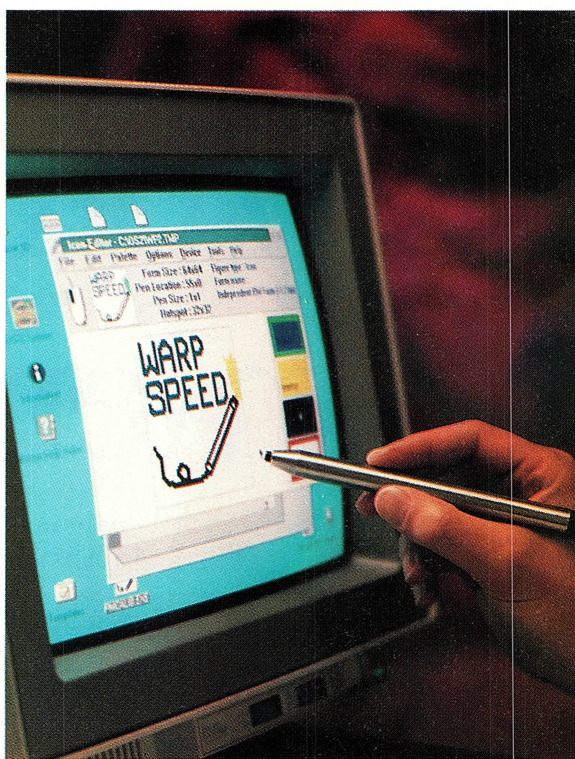
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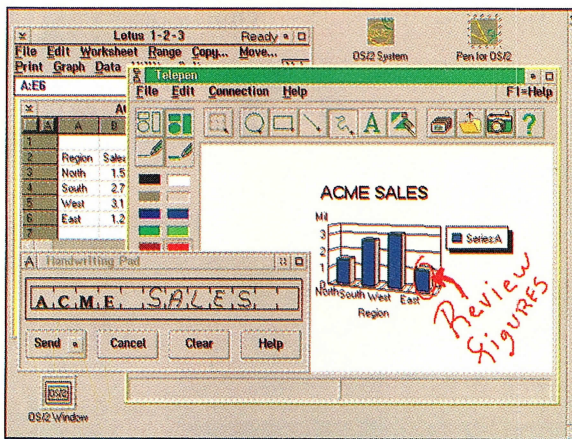
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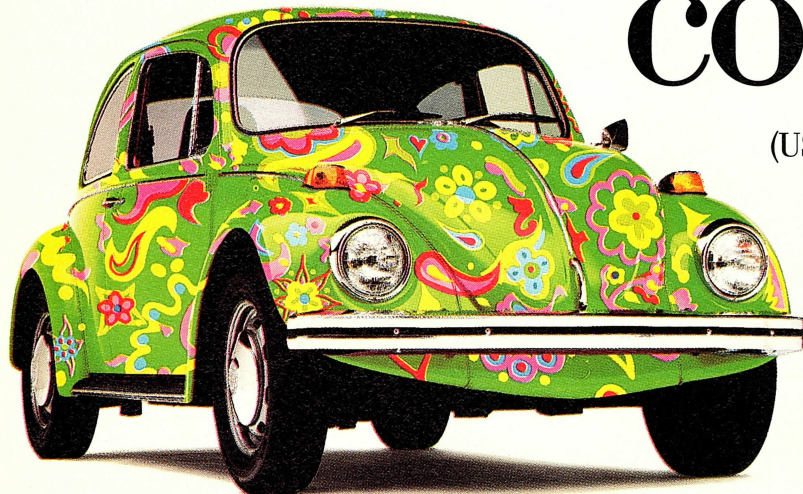
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Big Iron on the Desktop

CHANGING THE DEFINITION OF PERSONAL COMPUTERS BY AMY D. WOHL



Is there no limit, as the question goes, to the insatiable appetite of computer users for bigger and faster systems? Every year something faster, with more RAM, a bigger processor, and new features appears, making the computer you bought only a year or two ago hopelessly obsolete—or at least, less desirable.

Interestingly, these seductive objects don't usually cost more. New computers are always priced about the same. New items in each category, from high-end machines for big number crunching problems like graphics, to professional workstations for corporate computer jocks, to systems for happy home users, are available at a relatively fixed price. Aging equipment gets cheaper (because it's no longer state of the art) and the new items in each category enjoy a relatively stable price, making them easier to sell. Each year it looks like you're getting much more for the same number of dollars—and you are. You only need to belly up to the bar and pay—all over again.

We are entering a challenging time when we are confronted with far too many exciting choices all at once. These new choices could have wonderful effects by doing today's work much faster, or by creating tomorrow's new and indescribable delights. But to reach this nirvana, we must choose the best road to take us there.

Choosing becomes very painful,

**The road to
computing hell is not
only well paved, but
broad, smooth, and
bordered with slick
salesmen.**

because the joy of buying and opening our new toys is marred by the possibility of a bad choice. Unfortunately, the road to a good choice is narrow (although it is, for the knowledgeable, well defined), while the road to computing hell is not only well paved, but broad, smooth, and bordered with slick salesmen, beckoning us onward.

In 1994, you will once again look at your desktop system and find it wanting. I can say that with confidence, because it almost doesn't matter what you've got. (Unless you've already bought a Pentium, in which case you probably don't read articles like this, except to murmur in a superior way—but read on, we'll try to scare you anyway.)

If you're sitting at a 386, you get to choose between a 486 (the economical choice), a Pentium (still pretty pricey, unless and until Intel

gets scared enough about the PowerPC to adjust their pricing), and a RISC workstation. We'd guess that most business people will still buy 486s this year, until the Pentium price changes.

I think you should at least consider RISC machines. If you're an OS/2 user, that will mean, of course, that PowerPC will be your processor of choice, but we suspect that given the likely course of the market this year, PowerPC looks like a good bet anyway.

Macintosh users have it easier. When they see the performance for the Macintosh with PowerPC contrasted with ordinary Macintoshes, it will be strictly a checkbook decision. If you can afford one, you'll buy it. Apple must have an interesting new pricing strategy in mind for the high-end Quadras, because we've seen vendors running the same packages on both (with the PowerPC software in native mode) and you'll never keep them down on the farm after they've seen Paree!!! Apple will re-rationalize the product line by getting the education and home market (and perhaps the small business market) to buy ordinary Macs and everyone who can afford them to buy PowerPCs.

Since IBM (and others) will also be selling PowerPCs with other operating systems, the chip has a built-in advantage over other RISC chips from Sun, Digital, and HP, which will probably enjoy smaller markets (and, ultimately, less soft-

ware). Of course, if everyone can run a single version of an operating system like NT or we go to a unified UNIX, then these bets will change.

When you're in the market shopping for the new standard desktop, remember the iron rules of buying hardware. It's easy to win: Buy where the market is going because that's where the action will be. You'll find lots of software, lots of

peripherals and secondary vendors, lots of infrastructure (consultants, training, courseware, add-ons). There are only a few ways to lose:

- Buy a brand from a supplier who builds weird stuff for a while and then disappears. No one will ever build a peripheral. No one will be a second source. No one else will support it. When it

breaks, you'll probably be replacing it (with secret thanks that you now have a legitimate reason to buy a decent machine).

- Buy from a major vendor who won't license anything and can't figure out how to sell in volume. There will never be an adequate installed base to attract software developers, which is a sure formula for a painful death. Ask NeXT. Why do you think Apple now talks about the licensing policy for new products before they have the product specifications complete? In the era of open everything, proprietary anything is a kiss of death.
- Buy in a market with sparse software and not much hint of more coming and then be surprised you can't get what you need.
- Buy a product that doesn't work or doesn't work well, especially in a market with a single source.

The market is moving to richer, more functional software at every level, from individual consumer applications such as games and personal productivity to collaborative computing applications for corporate workgroups. All this functionality and complexity takes space (memory and storage) and performance. It's high time for us to take advantage of the opportunity the economics of information-processing technology provides (twice as much speed for half the price— every 18 months) and then move on. The age of CISC (complex instruction-set computers) seems to be nearly over. Barring a technological breakthrough, 1994 may well be the year when we change our minds about just what a personal computer is.

Amy D. Wohl is president of Wohl Associates, a consulting firm specializing in office information systems, personal computing, and end user computing. She is also editor of the Trendsletter, a monthly newsletter on computer industry trends.

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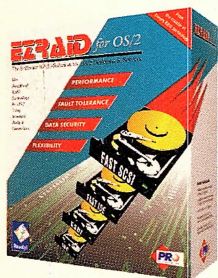
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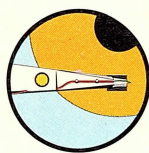
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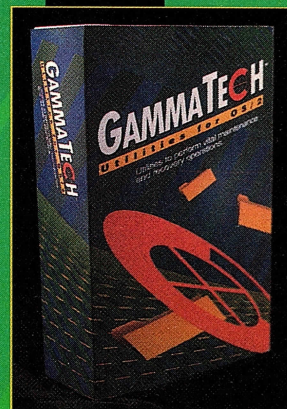
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Central Point Anti-Virus for OS/2

Through its history, OS/2 viruses have been virtually nonexistent—not that OS/2 is magically immune, although its memory protection mechanisms do help a lot. Largely, it has just been neglected in virus authors' quest for the greatest audience to harass. DOS viruses can get into an OS/2 system, however (in fact, there have been several recent reports of the DOS-based FORM virus destroying the OS/2 Boot Manager), and due to its increasing popularity it is likely that OS/2 will be targeted by demented hackers looking for new victims.

DOS-based virus scanners can run under OS/2, but they have no concept of extended attributes or the long file names of the High Performance File System. Besides, many people don't bother installing the DOS support in OS/2. Central Point has addressed these problems by introducing a 32-bit OS/2 version of their Anti-Virus software.

A well-designed approach

As with backup/restore software, this is the kind of product that may be especially needed when it becomes impossible to load OS/2. Central Point included a text-based boot sector and partition table checker that can be run after you've booted from your OS/2 installation diskettes. There is, however, an excellent Presentation Manager interface to the main program. By the way, an especially malevolent virus

**It is likely
that OS/2 will be
targeted by demented
hackers looking for
new victims**

might target the Anti-Virus software itself. While chances are good that the software would detect any such changes, I recommend playing it safe and running the software from a write-protected copy of the original diskette if possible.

The VWatch program, however, has one large drawback; it runs in the background, constantly monitoring programs, files, and diskettes for viruses. Unfortunately, this program only runs in a DOS session. This isn't entirely bad, since it means that you can have some protection even if you dual-boot over to DOS by running VWatch. And, it is true that the greatest danger of infection at this point is through DOS sessions. Still, it is of no value to those who aren't using DOS support or don't want the overhead of a continuously-running program in their DOS sessions. I'd like to see Central Point implement an OS/2 device driver version of this program.

Performance is reasonable, though not exciting, with a com-

plete detection scan of my 510MB 12ms IDE drive (450MB full) taking 18 minutes, while I ran other programs in the foreground. This utility is a well-written OS/2 program that had little effect on the performance of other applications running while it ran in the background. Under those circumstances, I'm happy to trade execution time for thoroughness.

I appreciated the detailed list of viruses and their symptoms included for browsing, but it isn't complete. A scan of my disk brought up a warning that the "Encrypted" virus was found in a file. Scanning the virus list, however, turned up no such virus.

More than just virus detection

Depending on the virus and the depth of infection present, many viruses can actually be cleaned up. Like human diseases, the earlier a computer virus is detected, the greater the likelihood of a complete cure. You also have the option of deleting the file in question. I recommend that you change the default to "wipe" the file rather than deleting it. A normal file delete really doesn't erase its contents, it just removes it from the directory. Until something else is written over that information in the course of normal activity, the virus still exists on your disk. Wiping the file actually clears every part of its contents from your disk.

The main detection and cleaning programs essentially scan the files on your disk for known virus "sig-

natures"—sequences of hexadecimal values found within viruses known to Central Point. More sophisticated viruses, however, can mutate into different forms that may not exhibit the fixed signature. And, of course, there are always new viruses being developed. Central Point included an expert system, called the Virus Analyzer, with intelligent algorithms to scan for anomalies in files and attempt to find such mutations and newcomers. By default, this analysis is conducted at the same time as a normal detection scan.

Another method used to detect unknown viruses is SmartChecks. The first time you run the program with this option, it creates files with information (particularly checksums) about all the executable files in each subdirectory. Future runs of the program compare the information here with the current state of your executable files (which rarely

change), and warn you of unexpected differences that can be an indication of infection. This feature can also be used as a shortcut in future runs. You can opt to check files only for changes against their SmartChecks, which runs quite quickly—at the cost of possibly missing some viruses. When you

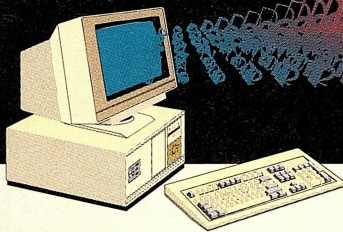
consider the additional overhead of these analyses, the performance seems rather remarkable.

With the corporate touch

Central Point has done a couple of things to make this product work better in the corporate environment. First, the messages are customizable. Thus, if a scan finds a suspect file, the user might see a message giving the phone number of the company's technical support group and instructions to call immediately. Second, the product is designed to work well on networks, claiming support for all network software supported by OS/2. In fact, there is a Network Loadable Module (NLM) version of the product. The network administrator can customize individual access rights to the executable program and report files, and tailor some of the other options. The documentation includes guidelines for development of a corporate virus response plan.

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Test Drives

Regular updates

Everyone wants to build a better mousetrap, and the program that finds all known viruses today may miss the new one inflicted on the world tomorrow. For \$49.95/year, Central Point offers a subscription service, with a year's worth of updates, one per quarter, to encompass newly-discovered virus signatures. Those who are looking for maximum protection may consider it a bargain compared with the cost of replacing the contents of their entire disk (or server, or network, or WAN...). Central Point also adds updated virus files to their bulletin board and their forum on Compu-Serve for downloading.

Glee or Flee

If you are using only packaged software from well-known vendors, you *may* be able to get by without a virus scanner. Especially if you backup your systems regularly. Still, remember that there are a number

of time-delayed viruses that you may not realize are there until you've gone through several generations of backup. **Both** backups and virus scans are needed for really safe computing. If you do any downloading of files from bulletin boards or on-line services, a good virus scanner is an absolute must. Central Point's offering does an excellent job, with the added benefit of doing so on long filenames in an OS/2 task that runs contentedly in the background.

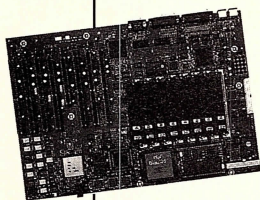
Hobbes OS/2 CD-ROM

One of the best aspects of on-line services is the wide variety of programs, files, and information available there. The Internet isn't really an on-line service along the lines of CompuServe or Prodigy. Rather, it's a set of cooperative relationships between corporations and educational institutions that allow the user access to dozens of separate

information sites. Myke Kretzer convinced the University of Waterloo to donate the disk space for a new Internet site, which became the largest gathering point for OS/2-based files. This site later moved to the University of New Mexico, where it became known as Hobbes and continued to attract OS/2 software. When they overflowed the 700MB drive the University gave them, IBM donated a new one. Walnut Creek created a mirror of this site, and pressed this conglomeration of information onto the Hobbes OS/2 CD-ROM. New versions of this CD are published quarterly (more or less), with selections from the latest contents of the Internet site at hobbes.cdrom.com included in one convenient package.

This heritage is significant. Habitudes of the Internet are largely the hackers of the world, who tend to throw together quick and dirty rou-

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tines and worry about documentation later, if at all. Don't expect a lot of instruction as to what's on this CD-ROM or how to get to it. What documentation there is exists in a couple of small text files on the disk itself. The rest of it is up to the industrious user to ferret out. Walnut Creek provides a VIEW utility to browse through the CD contents, but it uses an index file rather than the actual directories, and the utility occasionally bombs on not being able to find a directory it thought should be there. Still, it is a valuable aid for stepping through more than 3,600 files located on the disk, since brief descriptions of the files are included. (Author's Note: Walnut Creek later pressed a second version of the disk which fixed the directory problem, but removed the bitmaps.)

Looking for a new bitmap to use as your OS/2 desktop? You'll find more than 70 excellent possibilities here. Those doing desktop publish-

Looking for a new bitmap to use as your OS/2 desktop? You'll find more than 70 excellent possibilities here.

ing will be delighted to find approximately 500 new Postscript fonts on the disk. The CD-ROM includes so many icons that they broke them up into subdirectories based on the first letter of the icon name! You're bound to find just the right look for all your programs. It also includes dozens of games, from text-based adventure games to PM-based arcade games.

The UNIX lover will find much to cheer here. Those looking for a low-cost alternative to products such as the Hamilton Shell and the MKS Toolkit will find a wealth of convert-

ed UNIX utilities here, including a number of GNU ports. Those just starting to get their feet wet in development will find a complete C/C++ compiler. Keep in mind, however, that you get what you pay for—you should have a good understanding of these utilities before going in. Again, the documentation is minimal.

A number of fixes for OS/2 2.1 and the entire 2.0 Service Pak are also on the disk. The documentation, however, isn't extensive, so I would suggest that only intermediate to high-end users try these utilities. In addition, remember



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Test Drives

that your 2.x system runs the 16-bit 1.x programs just fine, so don't forget to check that part of the disk for goodies.

Power users of the OS/2 Enhanced Editor (EPM) should definitely consider this CD-ROM. The macro compiler is on the disk, with sample macros and help files. Files to automate communication with a mainframe through the EPM interface are also included, along with files for those using OS/2 on a LAN, including NDIS drivers, Netware requester software, and a number of LAN utilities. Device drivers are available here in abundance as well, so if you're looking for a device driver that wasn't included in OS/2, it might well be on the disk.

Keep in mind that some of the items on the Hobbes CD-ROM are shareware; if you decide to keep using them, you are obligated to register them with the owner, often with an additional fee.

Glee or Flee

The Hobbes OS/2 CD-ROM lists for \$29.95 for a single disk, or \$19.95 per disk for a subscription. If you subscribe, your credit card is billed each time a new disk is released and you can cancel at any time. If you're a computer veteran that doesn't mind getting your hands dirty, this disk provides an enormous amount of helpful material and should be considered a must. Even the intermediate user can get their money's worth here, although many of the utilities won't be used. The novice who never wants to see a command line, however, would be better advised to pass on this one.

Brian Proffit has been in the computing industry for 20 years. He was part of IBM's OS/2 team, left IBM to become the director of PC Week's Corporate Labs, and is now the president of Visionary Research. Brian is

the author of two books on OS/2: OS/2 Application Development Tools, and OS/2 Inside & Out. He has written for several publications, including Dr. Dobbs Journal and PC Week, and is a contributing editor for OS/2 Developer. He can be reached at CompuServe 75300,1466, or Internet 75300.1466@compuserve.com.

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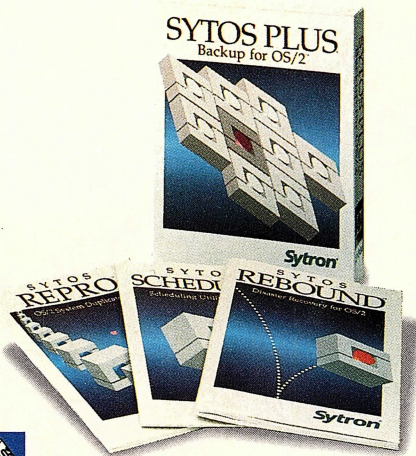
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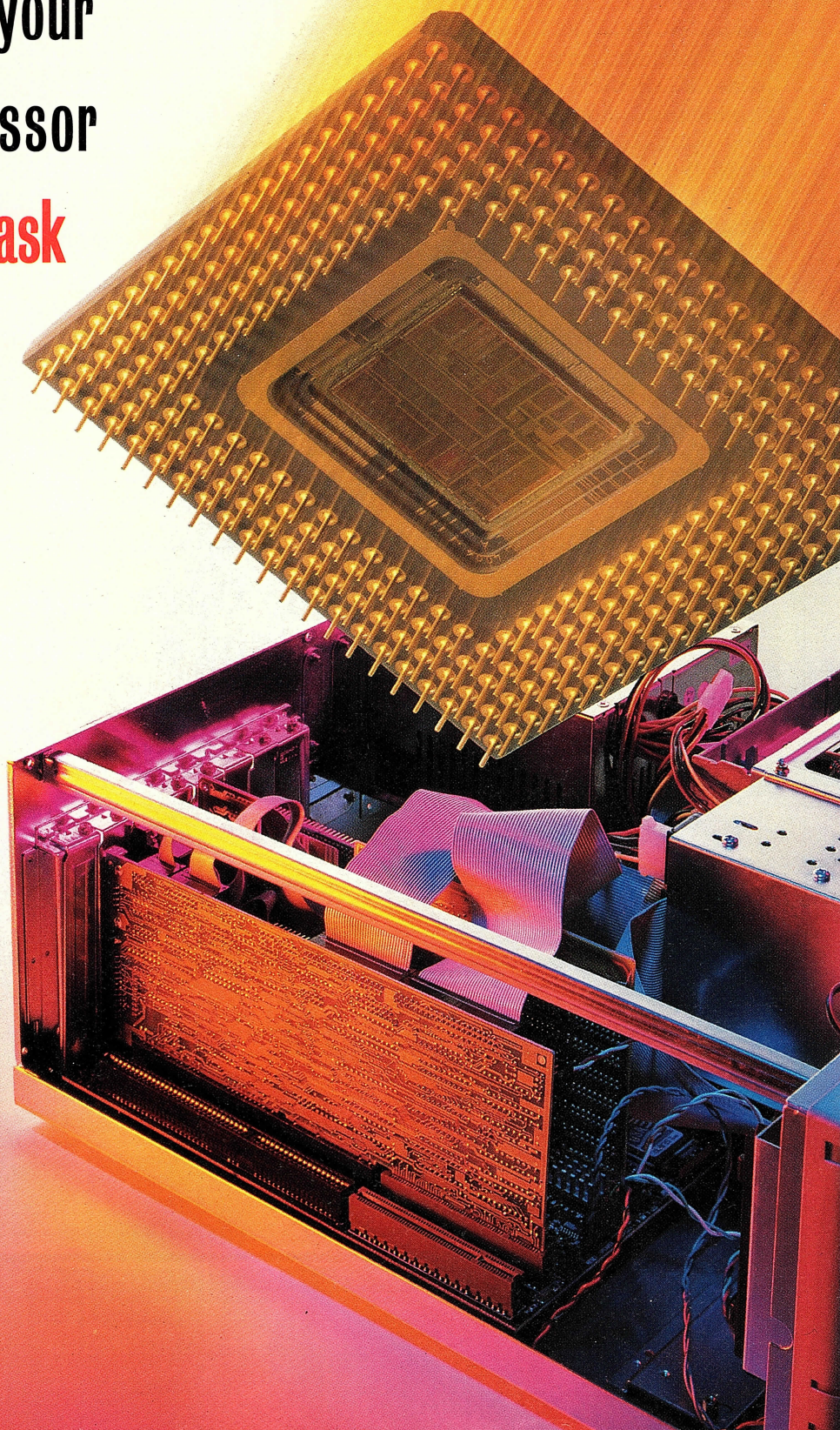
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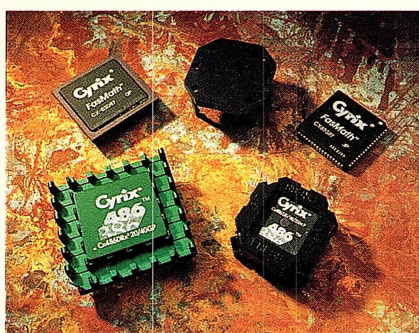
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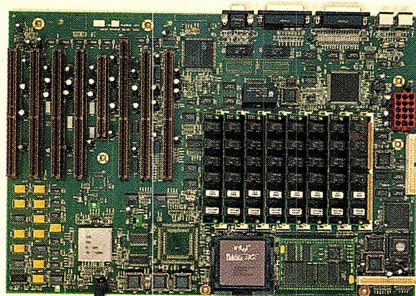
All about
upgrading your
PC's processor
by Matt Trask



New Chips For old



Do-it-yourself 486 processor upgrades from Cyrix can turn old 386 systems into modern power houses.



Reply Corp. offers a full line of replacement motherboards for PS/2 computers.

Does your system seem to be just a little bit slower than it used to be? Lately, have you caught yourself sneaking covetous glances at your coworkers' new 66MHz 486 systems? Do you have Pentium dreams on a 386 budget? When your computer was new, it probably provided more power than you thought you'd ever need, but now that you're using a real operating system you could probably benefit from a little more horsepower under the hood. Purchasing a new computer might satisfy that craving for power, but what can you do if the budget says "No way!"?

Your computer contains four subsystems that can be upgraded to increase system performance when running OS/2: memory, video, disk, and CPU. Of these, memory is usually the easiest to improve and can often make a significant difference. While OS/2 can actually be persuaded to run in four mega-

bytes, an increase to eight or 12 megabytes makes a dramatic difference in system performance. Increases beyond 12 megabytes make a marked improvement if you multitask many different applications or use large databases or multimedia programs.

Video upgrades such as the use of an accelerated display adapter to replace a standard VGA are often the best budget upgrade. Display adapters with graphics accelerator chips like the XGA and S3 family can off-load graphic tasks from a less-capable CPU and offer a significant increase in system performance.

Modern hard disks are much larger and faster than those created just a few years ago. Smaller form factors mean less distance for read/write heads to travel so data can be accessed more quickly. Newer disk drives include cache memory that can buffer full tracks

of disk data, further reducing access time. Retail prices for these new devices have dropped below a dollar per megabyte, a price unthinkable just four years ago. The addition of a faster disk drive can improve system performance under OS/2 because the disk is used to provide virtual memory when you try to run more programs than can be held in RAM.

Processor upgrades are the fourth opportunity for increasing the performance of OS/2 running on an older computer system. In fact, some non-OS/2-compatible 286 systems can have their CPUs replaced by 386- or 486-family processors.

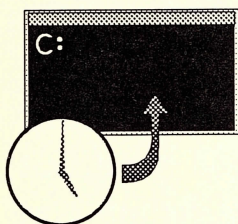
The personal computer industry has a long tradition of providing upgrade products going back to the days when add-in 80286 processor boards were used to speed up the original IBM PC/XT. In addition to processor upgrades, the standard-

ization of the AT cabinet and power supply permitted those of us with proficiency in screwdriver operation to replace complete motherboards in older systems while reusing adapters and peripherals. Alas, until recently, no such option has been available for owners of Micro Channel computers.

Setting expectations

CPU upgrades are the most popular and effective way to increase the performance of older systems when running OS/2. Before we start looking at individual upgrade products and technologies, what exactly should you expect to get from such an upgrade? There are products that install 386DX CPUs into PC compatibles with the original 1982-era 8-bit bus, but that is akin to attaching an 8-cylinder engine to a moped—the rest of the system just isn't suited to that kind of use. In particular, a product that adds a

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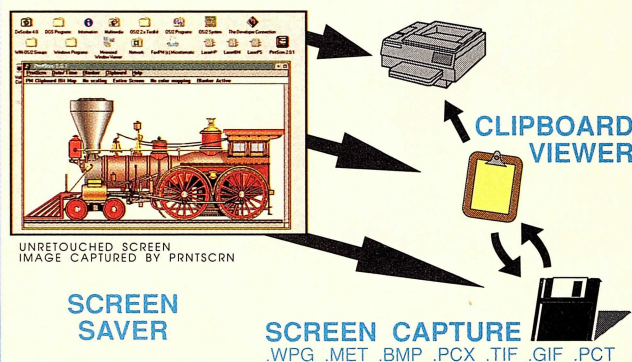


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486 CPU to a 286-generation computer may cause dissatisfaction if the rest of the system is not upgraded to match. The disk drives, video resolution and memory capacity of older systems may limit the ability of a new 486 processor and prevent it from operating anywhere near its designed capacity. If other subsystems are upgraded to match a new processor, it is often less expensive to buy a complete new system.

Given the major drop in computer prices in 1993, why would you want to upgrade? Perhaps you own a late-model 386 computer that already has a graphics accelerator adapter and a high-speed SCSI disk subsystem. Or maybe you own an expensive brand-name system and don't want to buy some no-name clone motherboard when you've already paid a premium price for a premium quality system. Another reason for upgrading would be if you chose a strategy of incrementally building a high-performance system in the past where you invested in fast disk and video subsystems while waiting for CPU prices to come down.

Is your system covered by a maintenance contract? If so, be sure to ask your vendor if a processor upgrade affects your warranty or service agreement. In most cases, such a change is covered under the same terms as other adapters and peripherals that have been added to the system.

Whatever reason leads you down the path to a processor upgrade, three different types are available: processor-only, processor adapter, or complete motherboard replacement. A motherboard swap may yield greater performance than the other two choices but usually requires more effort to completely disassemble your computer. A processor-only upgrade is usually much quicker, often taking as little as five minutes to perform. One other advantage of a complete motherboard swap is that you get

the opportunity to get new features such as a high-performance Vesa Local bus.

Processor-only upgrades

Perhaps the best known method for upgrading an existing system is the much-hyped Intel OverDrive processor. This is a special version of the 486DX2 CPU that includes one extra pin on the chip. If you examine the underside of such a chip, you will see a single extra pin in an inside corner that is used by the system to disable an existing 486SX processor that is soldered to the motherboard. Internal clock-doubling technology allows these chips to run twice as fast as the original CPU. Two flavors are available: the DX2-50 is for use with 25MHz computers and the DX2-66 works with 33MHz systems. They can also be used to upgrade standard Pin Grid Array (PGA)-style 486 processors that can be removed from Zero Insertion Force (ZIF) sockets.

OverDrive chips add horsepower to 486 systems but they don't do anything for those of us who have older 386-class machines. Cyrix Corp. offers a line of 486-compatible processors that are designed to plug directly into a 386DX PGA socket. Their 486DLC design is quite inexpensive, but is only intended for OEM use because its cache-control logic doesn't work with many older 386 designs.

Cyrix now offers a consumer-oriented line of clock-doubled 486-DX2 processors that is packaged with simple instructions and all the necessary tools for a do-it-yourself CPU swap. These chips are available in a full range of clock speeds and even in a clip-on form factor for use with 386SX computers. Performance increases of three to four times over the original 386 CPU are typical.

One aspect of using a Cyrix CPU requires additional attention—most 386 computers don't have the

necessary BIOS code to enable the on-chip cache that provides most of the performance improvement. A disk is included with a collection of utility programs that can be run during system startup to enable the CPU cache.

CPU modules

A separate type of processor-only upgrade is described as a CPU module or processor complex. This device uses some sort of riser card or circuit board to adapt a higher performance processor to the system. An example of this approach is the IBM PS/2 Model 95, which has its 486 CPU on a separate circuit board attached to a special connector.

Kingston Technologies offers a selection of CPU modules that can be used to upgrade 286 and 386 systems under the brand name SX/Now. These devices use a standard CPU soldered onto a small circuit board that contains any necessary logic for translating signals between the new processor and the older motherboard, and come in a variety of shapes for use with different computer systems. It is one of the few available solutions for upgrading a 286-based computer without doing a complete motherboard swap.

The Kingston 486 SLC/Now uses a 50MHz IBM SLC2 CPU to replace the 286 processor in PS/2 Model 50 desktop systems. Be aware that the eight-cylinder moped problem described earlier might strike you if you choose this solution—the original 20MB disk drives provided with these systems are extremely slow by modern standards. Kingston's answer to this problem is an adapter called the DataCard that adds more memory and a fast 2.5-inch disk drive with capacities up to 210MB.

Processor adapters

The other alternative to a complete motherboard swap is a category

Table 1: Measuring performance improvement.

	Before	After	% Improvement
SI, Norton Utilities Version 4.0			
Gateway 2000, 386DX-25	24.3		
Cx486DrX-25/50		86.8	357%
Cx486DLC-40		82.2	338%
Klone, 386-33 w/Cache	40.5		
Cx486DrX-33/66		122.1	301%
PS/2 Model, 55SX-16	15.3		
Reply 486SLC2		66.4	433%
Cx486SrX2-16/32		56.1	367%
PS/2 Model 50, 286-10	9.8		
Kingston SLC/Now 486SLC2-50		63.0	641%
Kingston McMaster 486DX-33		51.1	521%
PS/2 Model 80, 386DX-16	17.6		
Aox MicroMaster 486DX-33		50.7	288%
Reply 486DX2-66		102.6	583%
Klone, Intel 486-33	51.6		
Intel OverDrive 486DX2-66		98.0	189%
SI, Norton Utilities Version 6.0			
Gateway 2000, 386-25	12.3		
Cx486DrX-25/50		58.7	477%
Cx486DLC-40		65.7	534%
Klone, 386-33 w/Cache	35.7		
Cx486DrX-33/66		92.4	258%
PS/2 Model, 55SX-16	8.9		
Reply 486SLC2		71.3	801%
Cx486SrX2-16/32		37.1	417%
PS/2 Model 50, 286-10	5.5		
Kingston SLC/Now 486SLC2-50		37.1	674%
Kingston McMaster 486DX-33		71.3	1,296%
PS/2 Model 80, 386DX-16	11.0		
Aox MicroMaster 2486DX-33		27.3	248%
Reply 486DX2-661		77.1	700%
Klone, Intel 486-33	71.9		
Intel OverDrive 486DX2-66		95.0	132%
Landmark System Speed Test Version 2.0			
Gateway 2000, 386DX-25	24		
Cx486DrX-25/50		127	529%
Cx486DLC-40		130	542%
Klone, 386-33 w/Cache	39		
Cx486DrX-33/66		196	502%
PS/2 Model, 55SX-16	16		
Reply 486SLC2		116	725%
Cx486SrX2-16/32		88	550%
PS/2 Model 50, 286-10	9		
Kingston SLC/Now 486SLC2-50		107	1,188%
Kingston McMaster 1486DX-33		111	1,233%
PS/2 Model 80, 386DX-16	19		
Aox MicroMaster 486DX-33		93	489%
Reply 486DX2-66		223	1,174%
Klone, Intel 486-33	113		
Intel OverDrive 486DX2-66		225	199%

called processor adapters. These adapters are usually full-sized cards that plug into a bus slot and take over control of the system from the original CPU. Other than CPU modules, these adapters have been the only solution for users of Micro Channel systems until recently because the plethora of aftermarket motherboards available for the ISA market has not been available for these systems. One advantage of this technology over the two previous choices is that the vendors can add large quantities of high-speed memory on the card that can be accessed more rapidly than might be otherwise possible on an older system. It is also possible to add improved I/O functionality such as an accelerated video subsystem.

Perhaps the best-known processor adapter on the market is the AOX MicroMaster. This 486DX card can contain up to 16MB of RAM and is used to upgrade 16-bit or 32-bit Micro Channel systems. It does this by using a Micro Channel procedure known as Bus MasterShip that allows it to arbitrate for control of the system bus and then operate the system as if it were the original CPU. Kingston Technologies sells a newer version of this product with the brand name McMaster. An option connector on the McMaster permits the addition of an SVGA video module that upgrades the limited graphics resolution that is built onto the motherboards of most Micro Channel systems. Other vendors of processor upgrade adapters for the Micro Channel Architecture include Xtend Technologies and Seattle Telecom and Data.

Motherboard upgrades

Complete motherboard replacement has been the traditional upgrade path for owners of ISA systems. The cabinets and bolt-hole patterns of these systems have been standardized to a point that almost any AT- or tower-style com-

puter can be improved for a few hundred dollars with nothing more exotic than a screwdriver. Weekend computer shows and flea markets are held regularly in most metropolitan areas and a knowledgeable user can buy a new motherboard for anywhere between \$100 and \$500 with every type of CPU configuration imaginable. Motherboards are also available from a variety of mail-order sources that can be found advertised in the back of many popular computer magazines.

An IBM spokesperson once claimed that the lowly PS/2 Model 50 was the best selling computer of all time, with total sales quantities exceeding any other personal computer ever built. With a market size like that, it is not surprising that some entrepreneur decided to fill the need for upgrades. Until recently, this option was not available for owners of IBM PS/2 Micro Channel

computers because the mechanical layout of the cabinets for these systems bears little resemblance to the original AT-style chassis.

Last year, Reply Corp. announced the availability of a complete line of replacement motherboards for IBM's PS/2 computers. These are bolt-in replacements that are similar to what has been used for years in ISA systems. The upgrades for Model 50 and Model 55 computers use IBM's 486SLC and SLC2 processors while providing the same number of slots as the originals. An Intel 486SX-25 is used for the PS/2 Model 30 with an overdrive-compatible ZIF socket. The Model 60/80 upgrade uses a ZIF socket with Intel 486DX and DX2 CPUs and can be upgraded with future generations of processors. It also provides seven full-length slots supporting 32-bit Micro Channel adapters. All of these products are sold directly via a toll-free number and also sold

directly by IBM under an OEM licensing arrangement.

The Reply upgrade motherboards are unique because, in addition to adding a more powerful CPU, they address the other three aspects of system upgrades that were described earlier: memory, video, and disk. These boards use industry-standard SIMM memory instead of the proprietary memory modules that IBM originally used. The Model 50 and 55 upgrades support up to 16MB of memory and the Model 60/80 can use up to 128MB of either parity or ECC memory. With the exception of the Model 30 upgrade, all of the Reply motherboards use a Cirrus Logic SVGA GUI accelerator chip to replace the standard VGA that came onboard in the original system. The Model 30 provides a local-bus slot for video adapters. These permit higher resolution, more colors per pixel, and speeds up certain

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common operations that OS/2 does when drawing components of the Workplace Shell or Presentation Manager on the display.

The last feature of these upgrades is in the disk subsystem. First, a little bit of disk history—Micro Channel computers use a slightly different type of IDE disk drive that is not compatible with standard AT-IDE drives. The MC-IDE drives are more expensive because they lack the sales volume that is found in the AT market. Reply integrated an AT-IDE interface onto the motherboard that operates popular IDE drives like the Western Digital Caviar series. This not only lowers the price of adding disk capacity, but also improves the performance of OS/2 because modern AT-IDE drives usually include on-drive cache RAM that can make them faster than some SCSI drives.

How much effort is involved?

This is by no means an exhaustive list of available CPU upgrades, but it should be sufficiently broad to give a flavor of the task ahead if you decide to do it yourself. How long does it take to do a processor

upgrade? As mentioned before, most of these products can be installed with nothing more than a screwdriver. Chip upgrades like the Intel and Cyrix products can require specialized tools to remove the original processor from its socket. Cyrix provides a pair of these tools in each package and they are quite simple to use. Chip replacement typically takes about five minutes but, in some systems, it might take much longer—if the CPU is covered up by a disk drive bay or power supply, motherboard removal is required.

The process of installing adapter-style upgrades is similar to installing any other adapter card such as a network interface or audio board, and often is easier than installing a CPU upgrade. This option will not work if you do not have a free slot in your system.

Motherboard replacement upgrades take longer to perform but are not particularly more difficult than any of the other choices. A typical swap takes about 30 minutes from start to finish. One area requires extra attention when changing the motherboard in ISA computers—the standard power supply provides two connectors that may damage the motherboard if they are swapped before reinstallation. I usually avoid this problem by marking an adjacent edge of both connectors with a permanent marker before removing them.

Problems to avoid

If your older 286 or 386SX system only has one or two megabytes of RAM, a processor-only upgrade will not enable it to run OS/2—be sure to plan for sufficient memory while shopping for your new CPU. Also, bus-master processor adapters like the AOX/Kingston McMaster can have potential conflicts with other busmaster adapters that will try to access RAM on the processor card. This occurs because the McMaster

usually wants to remap memory so that the original, slower system RAM is not used. If the original memory can't be removed from the system, the problem can be solved by selecting an unmapped mode of operation.

While the Cyrix DrX2 processors provide an easy and inexpensive upgrade path, they won't work with all 386DX and SX systems. Cyrix claims that greater than 95% of all computers will work with their CPUs but also gives a 30-day money-back guarantee in case it doesn't. Some older 386SX systems don't have the pin that Cyrix's SrX2 processor uses to disable the original CPU—they will send potential customers a diskette containing a test for this capability. Also, 386 computers with cache RAM on the motherboard will probably not show as great a speed increase as systems without cache memory.

What does the future hold?

Almost as long as there have been personal computers, we've been upgrading them as faster CPUs were invented. Intel has announced a Pentium-family processor internally named P24T that can be used to upgrade some 486 systems. IBM has licensed 486 technology from Intel and uses it to manufacture its own line of compatible CPUs. A clock-tripled version of the chip known as Blue Lightning capable of operating at 99MHz should be available in upgrade products within a year.

Cyrix has announced a Pentium-class CPU named M1 that should be available by the end of this year. One of its main features is that, unlike the Pentium, programs do not need to be recompiled to exploit the performance of this chip. No one has announced an upgrade product based on the part yet, but it is a sure bet based on the history of PCs that someone will

A word on benchmarking

Why use an ancient benchmark like version 4.0 of Norton's SI? Rather than debating the religion of who provides a better CPU benchmark, I decided to use three different popular ones. I've been using Norton's SI since its very first version, and even if it isn't the best one around, it has historical relevance to me because I've been using it to test the relative performance of CPUs for nearly 10 years. Later versions of SI use a different testing methodology that does not relate to the numbers obtained with older versions and thus cannot be used to replace many years of experience with older CPUs. I have included the results of both benchmarks, so you are free to use whichever version is useful to you.

find a way to adapt it for use in older systems.

The potential performance improvements and cost savings from upgrading your system's CPU can be compelling. Something as simple as changing a single chip can triple the speed of your computer. An inexpensive motherboard change can bring old PS/2 systems back from the junkyard. A degree in computer engineering is not required to perform this task—simple tools and patience are all that is needed to breathe many new years of life into your faithful old system.

Matt Trask is the President of Communica Inc., a system software development firm based on Cape Cod, Mass. that specializes in device drivers for OS/2 and other advanced operating systems. Trask can be reached on the Internet as matt.trask@bix.com.

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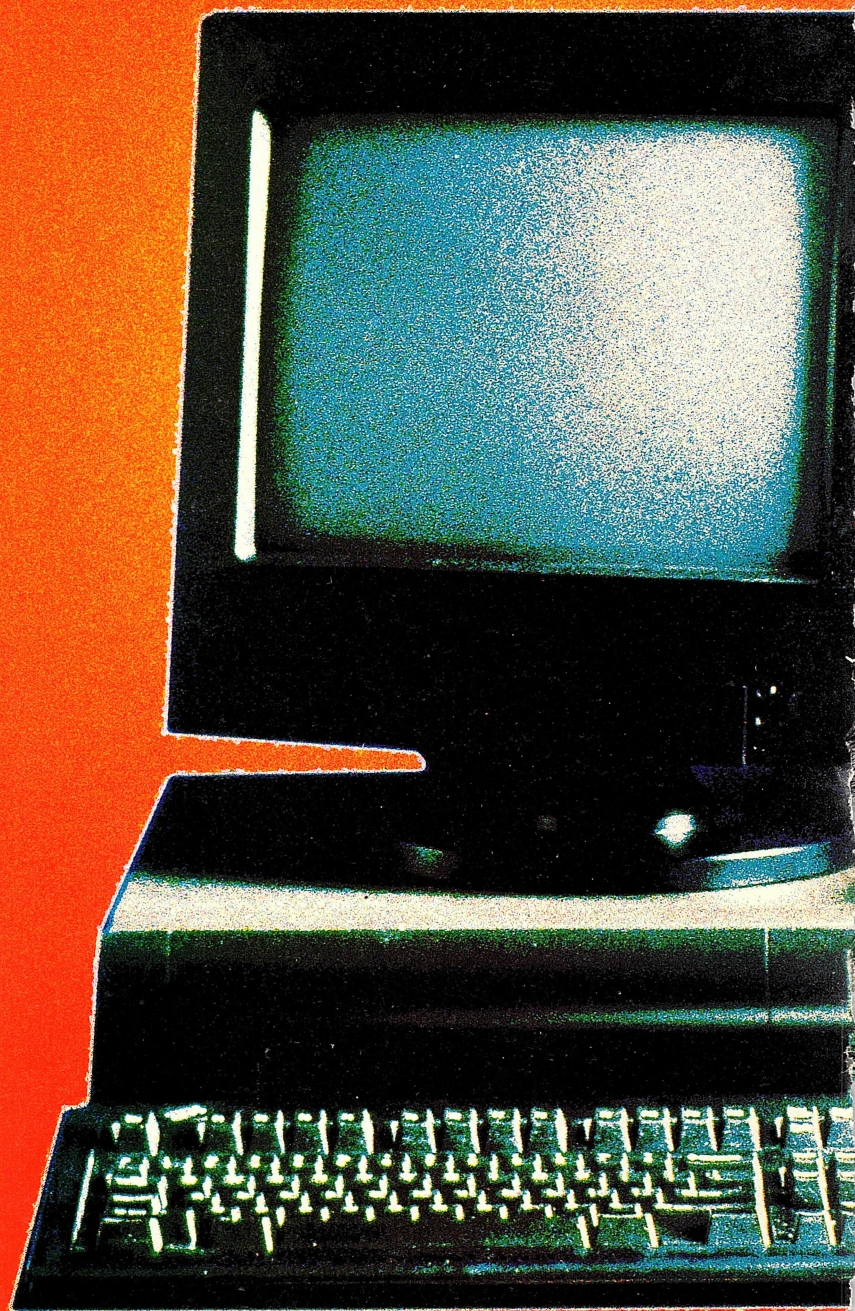
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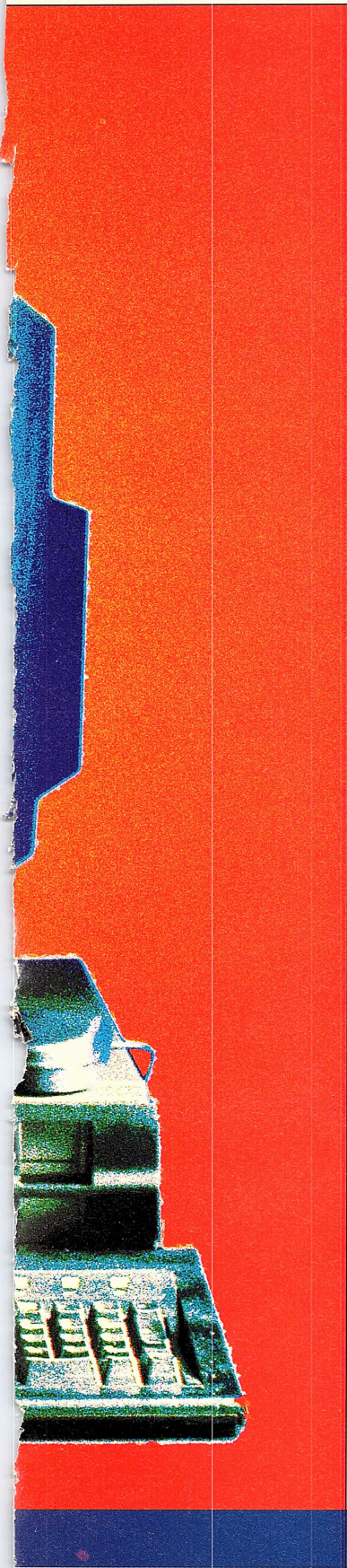
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Is the PowerPC- based Workplace/OS the successor to OS/2?

By Jeff
Duntemann



A prototype PowerPC reference platform. Photo courtesy of IBM.



Moving into a Non-Intel Future

I don't think I was ever so relieved in my life. Right there on the Las Vegas Comdex floor, in front of thousands of people, without any armed guards or lawyers, IBM was running Windows applications under AIX on an unannounced machine without a name. Inside the machine was not an Intel Pentium but the PowerPC 601 CPU chip, about which we've heard much and seen very little these past two years since it was announced. But there was Windows, running just about as fast as it would on my 33MHz 486 back at the office. I breathed a *very* deep sigh of relief. The PowerPC Alliance had pulled it off.

The revolt of the also-rans

In case you just tuned in, the PowerPC is the product of an alliance of IBM, Motorola, and Apple, announced in 1991. The mission of the alliance was to create a new hardware architecture for PCs that would break Intel's stranglehold on the PC industry, and (not incidentally) give the member companies a shot at regaining market share that all three had long been losing like arterial blood. A new high-performance reduced-instruction-set central processing unit (RISC CPU) would be available by 1993 and, by 1994, new machines with downward-compatible operating systems would be available from both IBM and Apple. The new machines would run existing PC and Macintosh applications with acceptable performance, and would run native applications (that is, ones written specifically for the PowerPC instruction set) with dazzling speed.

(A RISC CPU performs its functions by processing large quantities of relatively simple internal instructions. The PowerPC, Sparc, and MIPS R4000 are all RISC processors. The Intel x86 architecture, including the Pentium, is an example of a competing technology, called a complex instruction-set computer [CISC]. It works by processing smaller quantities of more sophisticated internal operations.)

Industry alliances sprout like crabgrass and die like tropical fish, so the announcement was widely yawned over at the time. The schedules seemed

insanely optimistic. How could anyone perfect a new, high-end CPU chip in less than two years? What does "acceptable performance" mean? And (coming from companies that did not have stellar records on price competition) how much would these strange new animals cost? Most of us (this writer included) rolled our eyes and went on to something else.

In the fall of 1993, things began to heat up. IBM announced availability of the MPC 601 CPU, the first of the PowerPC family. By November, it admitted that the MPC 603 CPU, with radical new on-chip power-management features, had reached first silicon. Technical documentation on both chips was released, and news stories on the PowerPC became regular items in the trade press. IBM and Apple both showed off machines at Comdex, including the system I witnessed running ordinary Intel-based Windows applications. Both IBM and Apple were jubilant in announcing that there would be systems—lots of them—rolling into the channel by mid-1994.

That old emulation black magic

This is a good place to answer what is perhaps the most often-asked PowerPC question: If it doesn't implement the Intel instruction set, how can it run Intel DOS, Windows, or OS/2 applications? And if the Intel instruction set has to be emulated, doesn't that bring execution speed down to a crawl?

Instruction-set emulation has been with us for a long time. When done crudely—that is, when each instruction is emulated by calling a subroutine that performs the "work" of the instruction being emulated—execution time goes out of sight. Modern instruction-set emulation changes nothing that does not need to be changed, and tries to keep changes so that they

can be used again and again, as (for example) when code is repeatedly executed in a loop.

Something that many people forget is that GUI-based applications, such as those written for OS/2 or Windows, spend as much as 90% of their time executing code in the environment's application program interface (API) that's part of the operating system. This includes graphics and windowing libraries and many other routine functions. IBM's PowerPC operating systems will already have such API code translated into highly-optimized native PowerPC code. Every time an Intel-based OS/2 application makes a call into the Workplace OS API, it is *already* running fast native code without any execution time penalty at all. So nearly all the time, an Intel-based program is running at native code speeds because execution is *outside* of the application and inside the PowerPC-based operating system.

This leaves the 20% of the time when an application is executing its own instructions. IBM's scheme for emulating Intel instructions is diabolically clever. PowerPC instructions are substituted for corresponding Intel instructions the first time a run of Intel code is executed. This dynamically-translated code is retained in a carefully managed cache that is functionally similar to a secondary CPU cache. ("Secondary" means outside the CPU, as opposed to a primary cache that is on the CPU itself.) The cache retains translated code as long as it can, so that when execution happens in tight loops, the code being executed is in the already-translated instruction cache. As long as execution remains in the cache, it will be running at native code speed.

The operating system's translation machinery doesn't necessarily wait for Intel code to be executed the first time to translate it. Trans-

lation tries to anticipate the path execution will follow, and while the application is down in the OS waiting for keystrokes or mouse clicks, the translator is busily translating into native PowerPC code the portions of the application that it guesses will execute next. That code will be ready in the cache when the user makes a choice. (Isn't multithreading wonderful?)

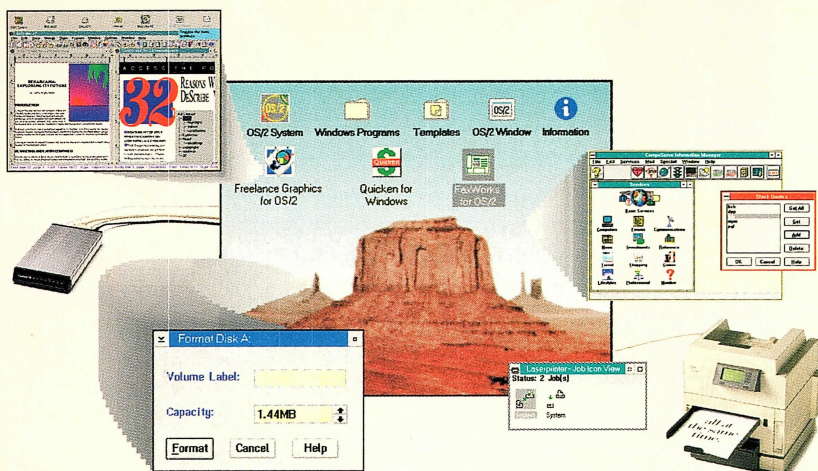
IBM estimates that an Intel-based application will execute in only about 1.4 times the amount of time it would take if it were PowerPC native code. Given the tremendous speed of the PowerPC CPU, that could still be considerably faster than a 33MHz 486 would run the original Intel application.

I saw a Windows program run under this emulation technology at Comdex. It was snappy even by my own standards, which are extremely high. Both AIX and Workplace OS will contain this technology when delivered.

Why doesn't the emulator simply save the translated code to disk and build a fully-translated executable file? Creating a second disk-based copy of an application is technically a copyright violation, and IBM does not want to create a new category of legal woes for itself. Also, its scheme depends on *executing* the code, because the emulator pays attention to tables and dynamic structures created during execution. Applications are rarely executed in their entirety in a single session; some dark corners of the code are hardly ever, in fact, executed at all.

The PowerPC reference platform

A very fast, relatively inexpensive CPU with cutting-edge emulation is what the PowerPC is. That alone doesn't guarantee that anyone will actually use it. There are other relatively inexpensive RISC CPUs, like the MIPS R4000, that have little



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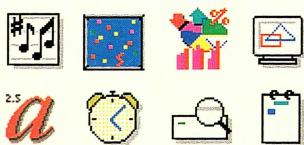
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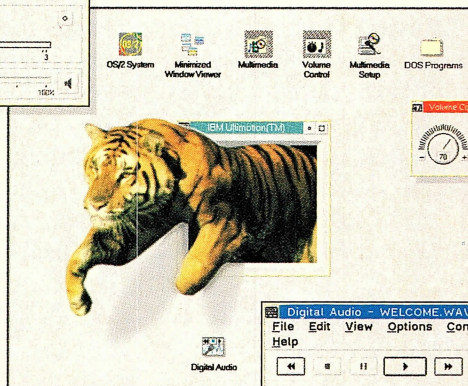
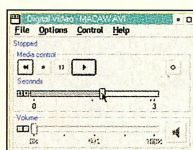


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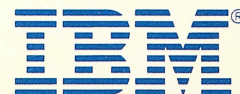
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hope of ever breaking out of the workstation niche. Some of what sets the PowerPC apart is the magic of its system software, with its dynamic translation features. What is less understood and probably more fundamental to the PowerPC's success is an absolutely astonishing strategy being pursued by IBM: They are attempting to turn their systems into commodities before those systems actually come to market. They are inviting other companies to clone them without legal threats or demands of royalties. A friend of mine called this "an act of mad brilliance." I think he's right.

For \$100, you or anyone can buy a document called *The PowerPC Reference Platform Specification Guide*. It's basically a blueprint for creating PowerPC-based systems that will be software-compatible with IBM's own systems. (How compatible Apple's systems will be with IBM's is not yet known.) The document lays out details of the PowerPC Reference Platform (PReP), an "imaginary" system containing the least common denominator of features IBM would like to see present in all PowerPC systems. It lays out memory maps, a power-on self-test (POST) sequence, the nature of a secondary (L2) cache and peripheral controllers, pinouts of the PCI and local-bus expansion slots, and a host of other necessary details.

A desire to ease compatibility with existing PC hardware is everywhere to be seen. PReP defines a "bus bridge," which plugs into the standard PCI bus and accepts expansion boards in various formats, including ISA, VME, PCMCIA, and Micro Channel. Video is Super-VGA compatible. Peripheral controllers will be mostly on the motherboard (although nothing requires this configuration) and adhere to the SCSI-II specification.

PReP specifies a CD-ROM drive in every system that has drives.

(PReP also specs out a diskless workstation for network use.) If third-party system vendors adhere to this request, PowerPC-specific software will almost certainly be distributed on CD-ROM exclusively, and will help accelerate the trend toward CD-ROM distribution for other platforms.

The universal CD-ROM drive has a partner in PReP that together make the PowerPC a multimedia vendor's dream: IBM is specifying high-quality audio support in every system. This "Business Audio" feature incorporates the Analog Devices AD1848KP stereo-capture chip, and performs 16-bit samples at 22.05KHz and 44.1KHz. Audio input, audio output, and separate line-in and line-out connectors are specified on the motherboard.

PReP's compact desktop and laptop specifications require two PCMCIA slots, which would greatly accelerate industry acceptance of the compact PCMCIA expansion devices.

The Commodity Gambit

The PReP document (even in the alpha release form I have) is large and complex, and will take some serious digesting by system designers. To help them get their machines to market quickly, IBM will engage yet another little-known strategy: It will sell finished manufactured system components—even complete motherboards—to OEMs. Why should IBM sell components to its competitors? For the same reason Intel did, back when the 386 was introduced: To give its new CPU critical mass in the marketplace, without which it can never be profitable.

IBM actually showed two unnamed PowerPC systems at Comdex: A high-end CD-ROM-equipped laptop and a book-sized compact desktop system with PCMCIA expansion and advanced power-management features. Few would buy such niche systems as one-offs

but, as part of a larger family of products selling by the millions, they become much more attractive. With a critical mass of commodity PowerPC systems to attract a software base, IBM could make a splash in the niche markets—and I would not write off IBM's ability to make money on commodity systems, given the recent success of their Ambra line.

Software to unify a fractious industry

What you probably want to know most about the PowerPC is, alas, that about which we know least: The system software and "native" applications. IBM was demonstrating their AIX flavor of UNIX at Comdex because AIX is the native operating system for the closely related RS/6000 workstations, and was the first to be operational on the PowerPC. AIX will run ordinary Windows applications through a translation layer called the Windows Application Binary Interface (WABI). I saw WABI at work at Comdex and it was very impressive. WABI was created by Sun Microsystems and will also be shipped with a native PowerPC port of the Solaris operating system (a version of UNIX) that Sun has announced.

Microsoft has not let its feud with IBM get in the way of their usual "cover the Earth" policy. Windows NT will be available for the PowerPC when the first systems ship. Intel emulation will be provided by Insignia Solutions, whose emulation credentials are excellent; they sell a utility called SoftPC, which allows Intel applications to run on 680x0-based Apple Macintoshes.

So where's OS/2 in this picture? Although IBM is counting on DOS and Windows applications running "out of the box" to sell the line, the "home" operating system of its PowerPC machines will in fact be Workplace/OS (WPOS), which is to OS/2 roughly what Windows NT is

to Windows. In addition to the expected WPOS native applications, WPOS will run Intel-based DOS, Windows, and OS/2 2.x applications under the emulation scheme described earlier. WPOS will support symmetric multiprocessing on hardware containing multiple CPUs. It will require the presence of a CD-ROM drive and will be distributed solely in CD-ROM format. Early specifications for WPOS indicate that it will run in an 8MB system, but 16MB is recommended, and will be required for software development workstations.

WPOS was not conceived solely for the PowerPC. It was created to be the eventual successor to OS/2, and was designed, like Microsoft's Windows NT, to be highly portable to diverse hardware environments. WPOS is loosely based on the Mach 3 microkernel originated at Carnegie-Mellon University in the early 1980s. The microkernel is the highly-independent heart of the operating system and coordinates the bulk of the work of the operating system occurring in distinct processes called *servers*, as well as all access to the actual hardware. The microkernel is the only CPU-specific portion of the operating system; everything else is written in highly-portable C. To move to a different hardware environment, only the microkernel itself need be rewritten. An Intel-based version of WPOS for 486 and Pentium is also in the works. IBM has said nothing about release dates.

An API-specific layer between applications and WPOS is required for applications to run. These layers, called *personalities*, are runtime-installable, and each is specific to a single API. In the first wave, there will be a DOS personality, a Windows personality, and a 32-bit OS/2 personality, with other personalities appearing later. IBM has suggested that a UNIX personality and a Windows NT personality may be offered and, if Apple were

willing to license its Toolbox code, nothing would stand in the way of a Macintosh personality as well. (Apple management fears, with some justification, that allowing Mac applications to run on non-Apple hardware could force Apple out of the hardware business entirely, as happened to NeXT.)

Operationally, running Intel-based DOS, Windows, and 32-bit OS/2 2.x applications under WPOS should be no more difficult than running DOS or Windows applications from OS/2. It is not yet clear to what extent 16-bit OS/2 applications will be supported.

The question of what operating system will be shipped with IBM's hardware depends entirely on what the customer orders. There will be no bundled operating system. IBM's stated intent is to treat all operating systems as peers, whether they come from IBM or not. They will gladly sell you Solaris or even Windows NT and install it on a system that you order. It's pretty obvious, however, that IBM will prefer to sell AIX "down" from its workstation market, and WPOS "up" from its PS/1 and PS/2 market. I personally will make the bald prediction that WPOS will within a year become the operating system of choice for the PowerPC. The operating system that has the largest installed base of compatible applications will win.

The unifying force

What is IBM actually trying to *do* with the PowerPC? Pretty obviously, IBM is trying to unify all desktop computing under one CPU (in the near term) and ultimately all computing of any size, under the single versatile Power architecture. I've seen the potential value in such unification more than once in my own shop. Some software simply can't be had for the PC but is available on the Macintosh—and I would buy a machine that would run both platforms well without

thinking twice. (Whether this happens is very much up to Apple now. If they refuse to license their system software to OEMs or sell it on the open market *à la* NeXT, I feel that they are doomed to remain a niche player in the market they helped create.) IBM's seriousness about this approach is reflected in the stunning change in corporate attitude that I have experienced in the past year, relative to my prior experiences since working at *PC Tech Journal* in the mid-1980s.

Will IBM and the Alliance as a whole succeed? That depends on how you define success. The IBM and Apple machines both work, and they will sell. The PowerPC as a commodity product will almost certainly make money, and may make a great deal of money. Whether that money is made by IBM and Apple depends powerfully on the nature of their marketing for the next three years.

Will they put Intel out of business, or even force Intel into a role as a minority player? Don't be silly. I think the most the Alliance can realistically expect by the turn of the century is 20 to 25% of the market, which would still be success on a staggering scale. Nor, I think, is that even the best measure of the PowerPC's success. I see it this way: *The PowerPC has the potential to break software free of the shackles of any particular hardware architecture.* That is a subtle kind of success, but a lasting one: It is the sort of success they will write about in technology history books in the year 2020. Like ENIAC, the System/360, the Altair 8800, and the original IBM-PC, the PowerPC will succeed by changing the way we think about computing. And that would be success beyond price.

Jeff Duntemann is the author of numerous books on computing, and is co-author of Inside the PowerPC Revolution, to be published by Coriolis Group Books in mid-1994.

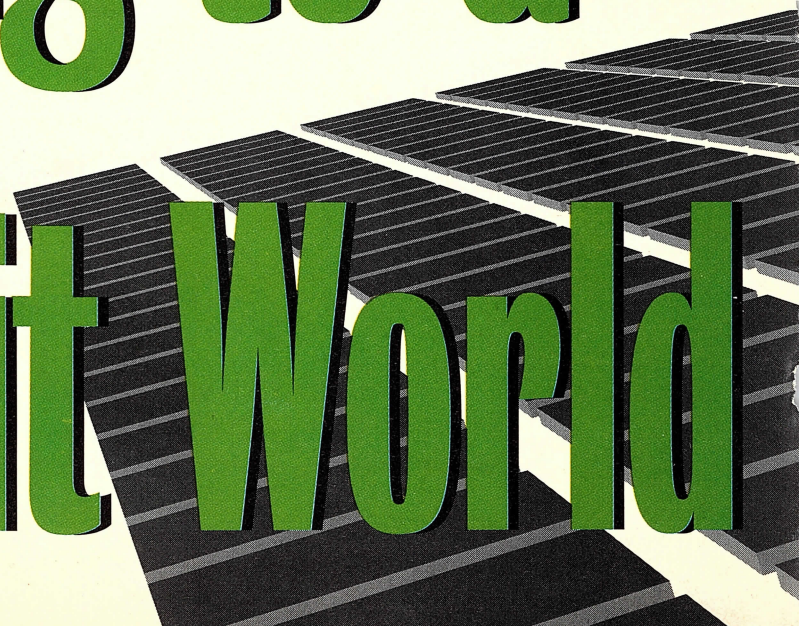
What's all the
high-
performance
hoopla about?
by Brian Proffit

Of course, *everyone* knows that 16-bit systems are passé. Admitting you still run on a 286-based machine plunges you into the depths of the computer ghetto. Even for laptop computers, a 386SX processor is barely entry-level today.

It's not just at the office; you're faced with the onslaught of "powers of two" at home as well. Every parent has been told that the old Nintendo was only 8 bits, and a 16-bit Super NES or Sega Genesis is required to run "the good stuff."

So what is all this funny bitness? Why is OS/2 2.1, as a 32-bit operating system, better than the older 16-bit models? As the marketing engines rev to full hype-speed over new 64-bit processors, should you follow the masses in moving to the next generation? Each of these jumps sounds like it gives you twice as much power. But is this assumption really true?

Moving to a 32-Bit World



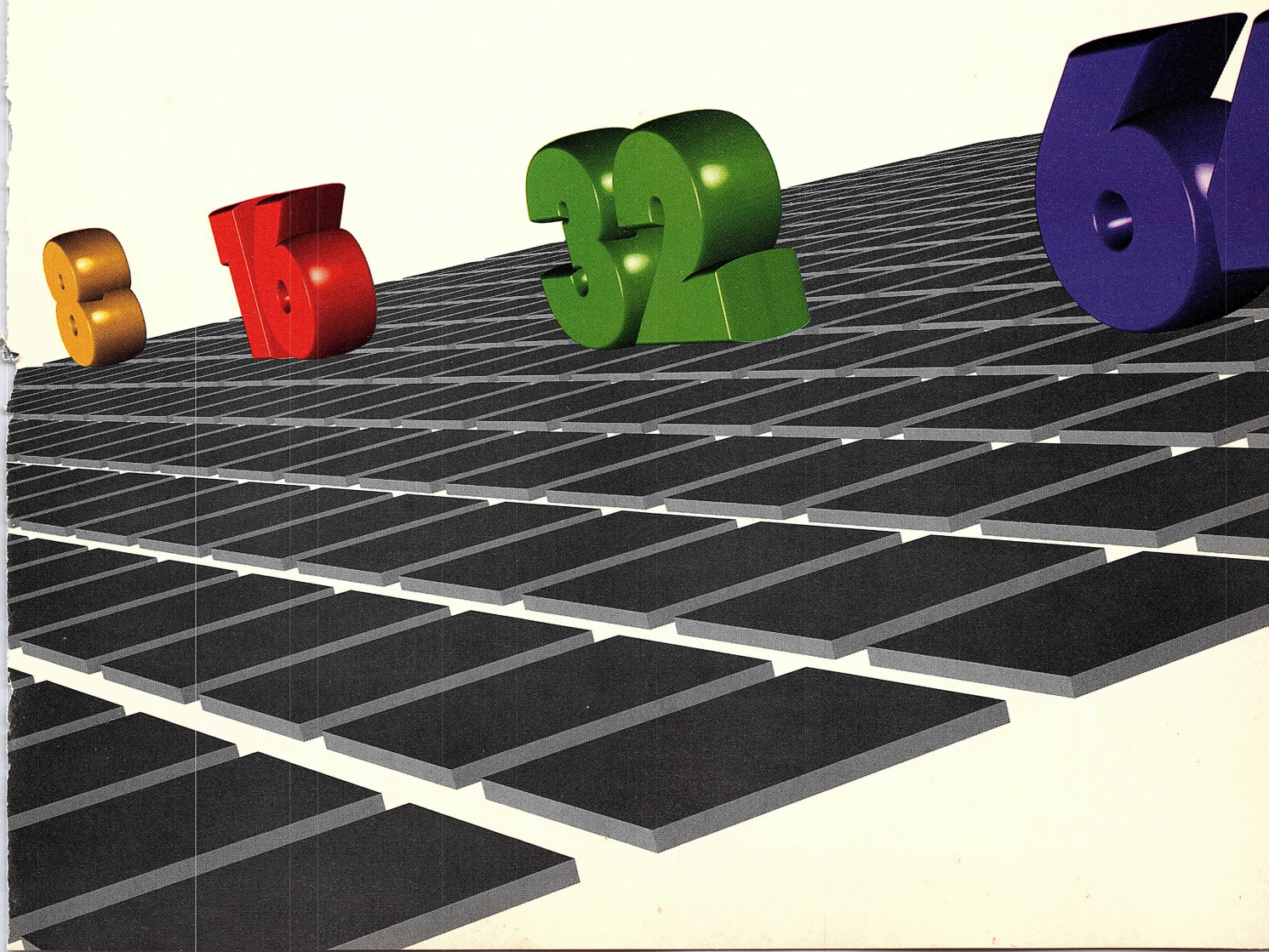
When eight was enough

Microprocessors began life as 8-bit systems. At its essence, that means that the internal registers—the part of the processor where all real work takes place—could hold eight bits of information at a time. A bit is a single one or zero (“true” or “false”). With eight bits, the largest value that could be operated on at any one time was $2^8 - 1$ (or 255). If the number could be negative, you had to reserve one of those eight bits for the sign, restricting you to plus or minus 127. If you wanted decimal places or larger numbers, you had to execute a series of instructions, working on pieces of the number one at a time to get the desired results. Since most instructions could only work on values in registers, adding two numbers greater than 255 could involve several move and add instructions, each proceeding at the clock speed of the processor. (Early PCs, like the

original IBM-PC and PC/XT, ran at 4.77MHz, meaning the clock ticked around five million times per second.)

Memory was also divided into 8-bit sections, called bytes. Moving information to and from memory took place eight bits at a time. Each of these bytes was separately addressable, but using only eight bits for an address would have restricted the main storage to 255 bytes—hardly sufficient! System designers decided to use two-byte addressing to allow 16 bits for addresses. This expanded the addressable area to 65,535 bytes, or 64K bytes, and was the basis for early systems such as the Commodore 64. (Remember that 1K, or a kilobyte in computer-speak, isn’t 1,000 bytes, but actually 2^{10} or 1,024 bytes.)

This amount was huge to those early pioneers who had been trying to develop software to work with 4K systems, but it began the seemingly eternal truth that



one's computing needs always grow to exceed one's capacity. In a decision that would plague programmers for many years, Intel developed a way to generate 20-bit addresses through the concept of segments and segment:offset addressing.

A segment address is a 4-bit multiplier, specifying the starting point for a chunk of storage within which addresses are 16 bits. The individual memory cells within the segment are addressed by their offset from the beginning of the segment. The 16-bit addresses allow up to 64K memory cells within a segment. The segment addresses themselves are also 16-bit quantities, allowing up to 64K separate segments. The address 003C:0049, then, refers to the 49th (hexadecimal) cell in the segment starting at address 3C*F (hexadecimal). The fact that the start of these segments were only 16 bits apart led to the strange truth that the address 12:1234H = 13:1224H, which got programmers into all sorts of trouble. Using this scheme, you could address 64K x 16 or one megabyte of memory. A megabyte is 1,024 kilobytes, or 1,048,576 bytes.

This one megabyte is the foundation upon which DOS was built, reserving the upper 384K for its own use, leaving 640K for programs. In short order, software vendors began running into these walls—both the 640K total limit, and the restriction of 64K per segment. Worse, the time spent loading segment registers to generate an address slowed programs down. It could take as many as 26 ticks of the processor clock just to load a segment register to prepare to move data to or from memory! Escaping all of these problems is the idea behind the "flat memory model" of a 32-bit system. Flat memory means that storage is viewed as one large space rather than a series of 64K chunks. There are no segments, and thus no segment-regis-

So far, IBM

IS TAKING A HARD LINE, SAYING THAT THE OS/2 PERSONALITY OF THE FUTURE WORKPLACE OS WILL ONLY SUPPORT 32-BIT FUNCTIONS.

ter loads. Large programs (those with many segments) could, therefore, get an immediate performance boost by moving to 32 bits.

There is a downside to this increase in performance, however. The 32-bit operations the new processors could execute took more clock ticks, and thus were slower than their 16-bit counterparts. For example, if you are adding two numbers that are larger than 16 bits, it is much faster to do a single 32-bit add than all of the moving and adding required to perform the same function on a 16-bit processor. If, however, the numbers are only 16-bits in size, the 32-bit add (with all the extraneous zeros in the top 16 bits) is slower than doing a single 16-bit addition. Thus, many programs that don't use larger numbers run more slowly in 32-bit mode.

Programs converted to 32-bit mode are often larger as well. To understand why, look at the kinds of things that take place in a typical program. One of the most common operations is to add one to some number. Whether you are stepping through memory locations, moving one cell at a time through a spreadsheet, counting the words in a document, or hundreds of other common tasks, the basic function of adding one continues to appear. The number one only requires a single bit to represent. Throughout your programs, then, are instances when 31 bits are wasted. Those bits do more than waste space, they waste time. They are all moved, copied, pushed, and popped with the single meaningful bit. The finer granularity of the 16-bit model, then, means much less waste under

some circumstances.

Operating systems feel the crunch

When OS/2 2.0 was released, people were shocked to discover that this new 32-bit version was noticeably slower than the older 16-bit OS/2 1.3 for many of the reasons mentioned earlier. The fact that OS/2 2.1 still contains some 16-bit parts in should not be an issue. In fact, it could be a performance advantage. The main thing in OS/2 2.1 that *must* support 32 bits is the Application Programming Interface (API).

The API is the part of the operating system that all software vendors use in their programs. Having a 32-bit API means that, for applications where it makes sense, developers can exploit the cleaner memory addressing and wider data path. On the other hand, the API should not be *exclusively* 32-bit. Forcing the migration of those many applications for which 32-bit is overkill simplifies operating system development, but forces vendors to ship slower, larger applications.

So far, IBM is taking a hard line on this situation, saying that the OS/2 personality of the future Workplace OS will only support 32-bit functions. Those who have used 16-bit API functions in their programs (the majority of existing OS/2 applications) will have to make changes, sometimes extensive, to their programs before they will run in the new environment, and the result of their effort may be slower programs. Many people are prevailing upon IBM to change this stance, but the reality is that the Mach kernel that serves as the base of the

Workplace OS and the OS/2 personality will make this technically challenging, requiring IBM to build a 32-bit-to-16-bit translation layer (called a "thunking layer") between the APIs and the kernel. This prospect is much more difficult, if even possible, in the hardware-independent Workplace OS environment than the Intel-specific environment of the current OS/2 product. It would have a dramatic impact on how quickly IBM could deliver the OS/2 personality (not to mention the size of the final product). It is much more likely that IBM will relent and convert some of the old 16-bit API functions to 32-bit.

The good news is that OS/2 itself won't go away just because the Workplace OS begins shipping. Those that don't need a version of OS/2 that runs on RISC machines can continue to run the current OS/2 2.x line, which IBM says will continue to be enhanced.

So which application should you buy?

Buyers should avoid the impulse to assume that 32-bit applications will, by definition, be better than their 16-bit counterparts. When Doug Hamilton moved the Hamilton C Shell for OS/2 from 16-bit to 32-bit, he says "It got big, it got fat, it got slow. It was a pig." Hamilton tried more than one compiler to try to improve the program, but the overhead of a 32-bit system overwhelmed the application. "In over 100,000 lines of code, there was only one page that really needed or used the 32-bit model. The rest of the time, a lot of wasted zeros are being moved around." When buyers call, Hamilton steers them toward his 16-bit product—which runs faster on OS/2 2.1 than the 32-bit version.

As far as customers are concerned, there should be absolutely no difference in an application's

look and feel—the difference between 16 and 32 bits is all under the hood. Still, there can be no doubt that the future is 32-bit and above. For most vendors, the 32-bit version of their product is the one that will receive most of their attention—both for technical support now and enhancements in the future. But don't feel pressured to move to the next release of an operating system or an application just because it exists. If what you have meets your needs, stick with it until you have a reason to change.

Brian Proffit was part of IBM's OS/2 team, and left IBM to become the Director of PC Week's Corporate Labs. He is now the President of Visionary Research. Brian is the author of two books on OS/2: OS/2 Application Development Tools, and OS/2 Inside & Out. Brian can be reached at CompuServe at 75300,1466 or Internet 75300.1466@compuserve.com.

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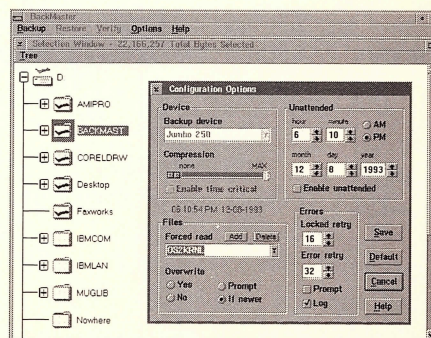
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Desktop Tuning Tips

Bigger screens, *autoexec.bat*, custom fonts, and colors By Lenny Bailes

Back in February, we put your OS/2 desktop to work by shadowing frequently used data files to a work folder and copying utility-program icons to an accessible desktop area ("Customizing your OS/2 Desktop," *OS/2 Magazine*, February 1994, pp. 44-50). This month, we'll look at more easy ways to make your desktop do more work for you—increasing the screen resolution beyond OS/2's default 640x480x16, creating custom *autoexec.bat* files for your DOS and Windows programs, changing the color and font of shadow icon titles, and installing PostScript fonts acquired for Windows desktop-publishing programs.

A bigger screen

OS/2 contains two mechanisms for modifying the screen resolution. If you didn't have access to the OS/2 manual, you'd intuitively use the Selective Install utility. But if you read the documentation, you'd learn about the DSPINSTL command, which can be issued from a full-screen OS/2 prompt. With DSPINSTL, you might be able to increase the default 640x480 resolution to 800x600 or 1,024x756.

If your system has a graphics card that OS/2 supports for high-resolution display, you'll be able to select it from the card-types listed in DSPINSTL's Primary Display menu. In many cases, after selecting

**After upgrading
the resolution, you'll have a
good deal more space on the
screen to open programs and
folders.**

Install Using Defaults for Monitor Type, you'll get a menu that allows you to choose between four 256-color display options. If you select 800x600 pixels or 1,024x768 pixels, OS/2 copies the proper drivers to your boot drive and updates Win-OS/2 to run at the same resolution. (If you have a video board based on the S3 chip, you'll need to download the S3 drivers from CompuServe or from another source. If you have OS/2 for Windows, the S3 drivers are included on a supplemental disk.)

After upgrading the resolution, you'll have a good deal more space on the screen to open programs and folders. At 1,024x768 resolution, you may find icon titles are too tiny to read if you only have a 14-inch monitor. Fortunately, you can adjust the font size using the Font Palette tool located in the OS/2 System Folder—but more about this option later.

Speeding display

OS/2's normal display mode, 640x480, shows 16 colors. Most high-resolution drivers you'll install with DSPLINSTL show 256 colors. The overhead required for this extra "color depth" might slow down the graphics display on your computer. You can speed it up again by adjusting the desktop's folder-display options. The "exploding windows" effect when you open applications or folders can be eliminated. Click

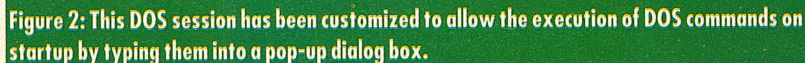
What if you don't need 256 colors? You can download a special 800x600x16 driver from the CompuServe OS/2 forum or from many bulletin board systems that carry OS/2 files. (Look for a file named *svga16.zip*.) This patch works with most video cards capable of high-resolution screen display. It seems to be as fast as the regular 640x480x16 driver.

The “Settings Book” for an application contains a number of options that affect the performance of your desktop. Here are some other useful tricks you may want to know:

- Path and Filename:* **command.com**
Optional Parameters: **/c**
[Enter a DOS command]

box to enter DOS commands (such as DIR, COPY, or FORMAT), or to run a DOS program. To keep the command prompt from disappearing when your instruction has been executed, change the `/c:` to `/k`

- By default, OS/2 will run only one copy of a program at a time. After you start a program, clicking on its shaded Workplace Shell icon returns you to the single open instance of the program. You can change the Work-



place Shell to run multiple copies of a program. For example, to use the System Editor to view multiple files simultaneously, open its Settings Book to the Windows page. Change Display Existing Window to

Create New Window. You can make the same change in DOS or OS/2 session icons to run more than one DOS or OS/2 session concurrently.

- The Session page for DOS and Windows programs controls a

variety of options that you can customize or fine tune. For example, applications can be set to open full-screen or in small graphical windows on the desktop. (For Windows programs, this ability is also referred to as a "seamless" Windows or Win-OS/2 session.)

- Here's a Win-OS/2 tip: Many Windows 3.1 applications copy DLLs and other information to the \windows or \windows\system directories upon installation. If you get a startup message from one of these directories complaining of a missing file, check for the file in the program's directory or in the directories for a pre-existing copy of Windows 3.1. OS/2 may have neglected to copy the auxiliary files to its own Win-OS/2 directories. If error messages complain of missing .exe, .drv, .ini, .dll, or 386 files, copy them to the \os2\mdos\winos2 and \os2\mdos\winos2\system directories and the problems should disappear.

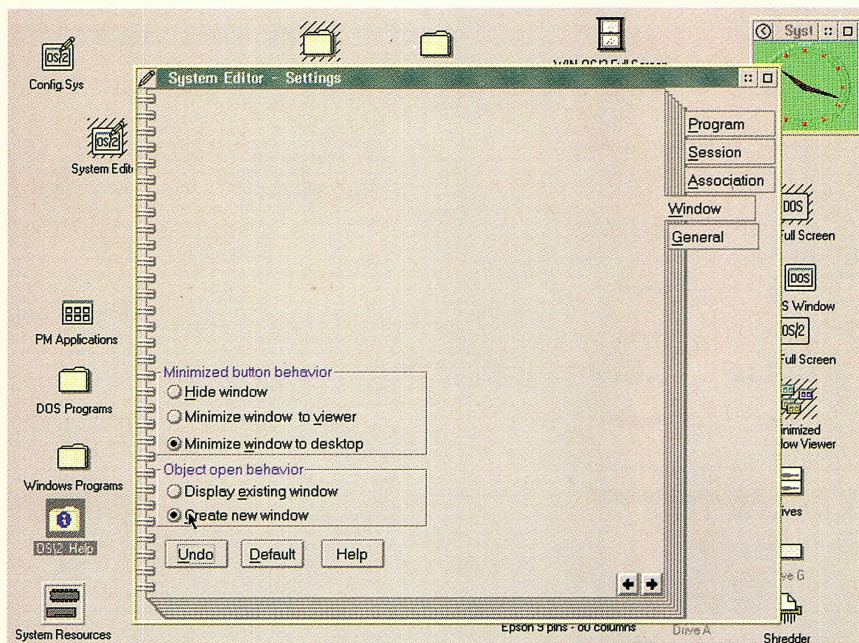


Figure 3: Multiple instances of an application can be opened when you select Create New Window in the Windows Page settings.

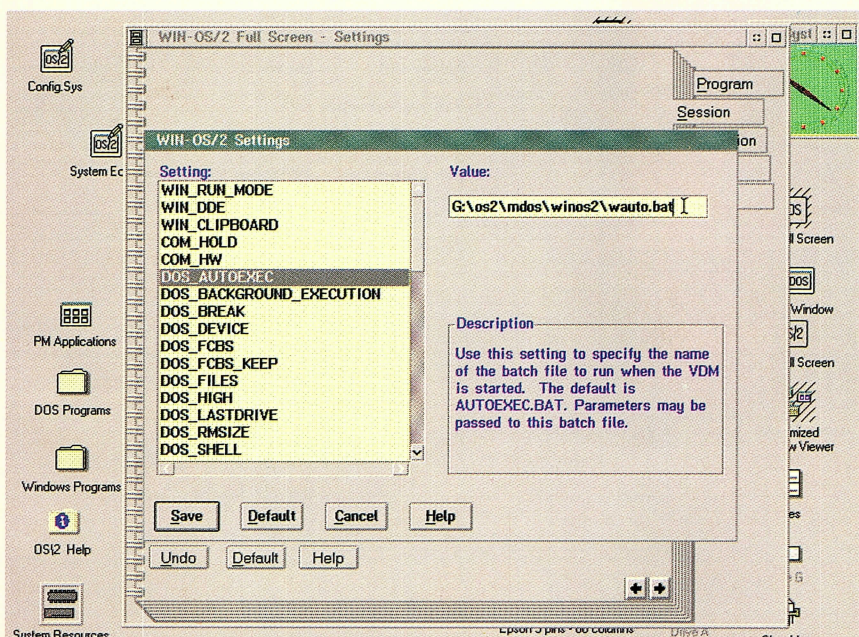


Figure 4: This Win-OS/2 session will run an alternate *autoexec.bat* before opening PageMaker in a Seamless Windows session.

Autoexec tricks

The menu of DOS and Win-OS/2 settings is a world in itself. One useful trick you can do with these settings is to specify an alternate *autoexec.bat* that runs before the main program is executed. For example, you may want to enhance the PATH statement for a Windows application, or preload a terminate-and-stay-resident (TSR) program such as a DOS fax driver. You can create and execute a special *autoexec.bat* to do these things. By default, when you open a DOS or Windows program, OS/2 runs the *autoexec.bat* found in the root directory of your OS/2 boot drive. However, perhaps you'd like PageMaker for Windows to be aware of a *d:\aldus* directory; and you'd also like to preload Intel's fax TSR. So, you can create a file called *wauto.bat* that contains the standard contents of *autoexec.bat* and the appropriate additional statements. Listing 1 (p. 47) is an exam-

ple, with the additions in bold.

To activate this *wauto.bat* file, open the Win-OS/2 settings... found on the Session settings page for PageMaker. Type:

```
c:\os2\mdos\winos2\wauto.bat
```

in the DOS_Autoexec option (sixth from the top—see Figure 4). When you start Pagemaker, OS/2 will run *wauto.bat*, loading the *casmgr* TSR utility before opening the seamless Win-dows session.

By the way, if you migrate or add Windows applications after OS/2 has been installed, the lack of correct path information in the *autoexec.bat* is a common cause for program failure. Creating custom *autoexecs* for individual Windows applications is one solution to this problem.

Also note that if you run two seamless Windows sessions concurrently, OS/2's default behavior is to run the *autoexec.bat* only once—for the first program that you launch. (This feature is designed to save memory.) You can compose a generic *autoexec.bat* for a group of seamless Windows applications and load it with the first program that you start. To force OS/2 to run a separate *autoexec.bat* for the second seamless Windows application, check Separate Session under the Win-OS/2 window on the Session page for the second program.

Desktop colors and fonts

The System Setting folder's tools can change the cosmetic appearance of the desktop. The Color Palette controls both the foreground and background colors for windows, borders, menus, icons, and icon titles. The Font Palette controls the style and size of the typefaces for individual desktop components. Most of the OS/2 desktop can be customized by dragging the desired color or font (with the right mouse button held down) to the window or desktop area where you want to make a change.

That's the good news. On the other hand, a few OS/2 areas can't be customized simply by dragging and dropping fonts and colors. Suppose you'd like to change the icon titles on desktop shadows to make sure they're not confused with ordinary file icons on the desktop.

(You may want to make them more visible with your favorite background color.) To change the color of shadow text you must open the Schemes Palette. Open New Scheme and in the pull-down menu under Window area, select Shadow Text and Edit Color. Move the mouse to

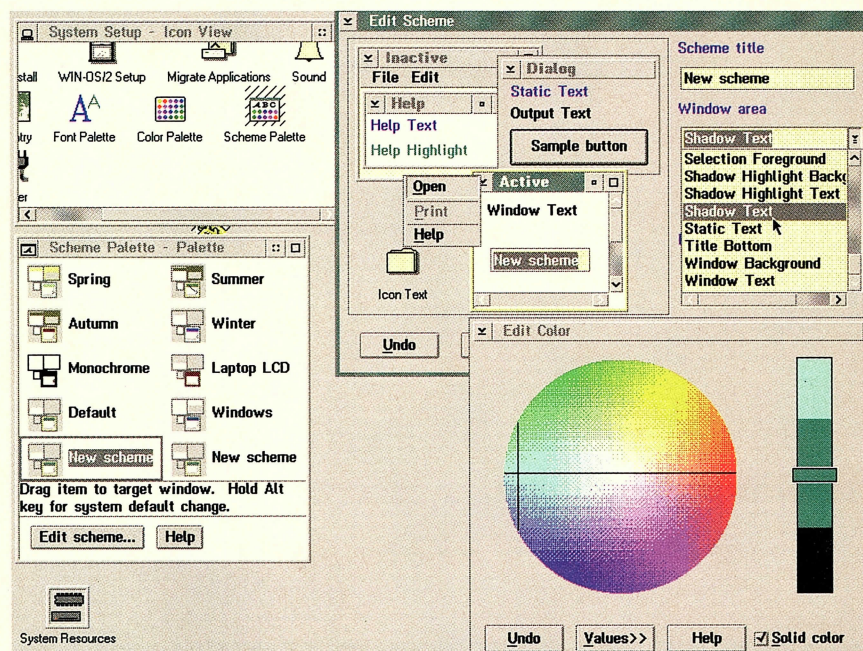


Figure 5: Through a series of menu choices, you can bring up the Edit Color dialog box to change the color for a specified desktop component. (In this example, Shadow Text has been selected.)

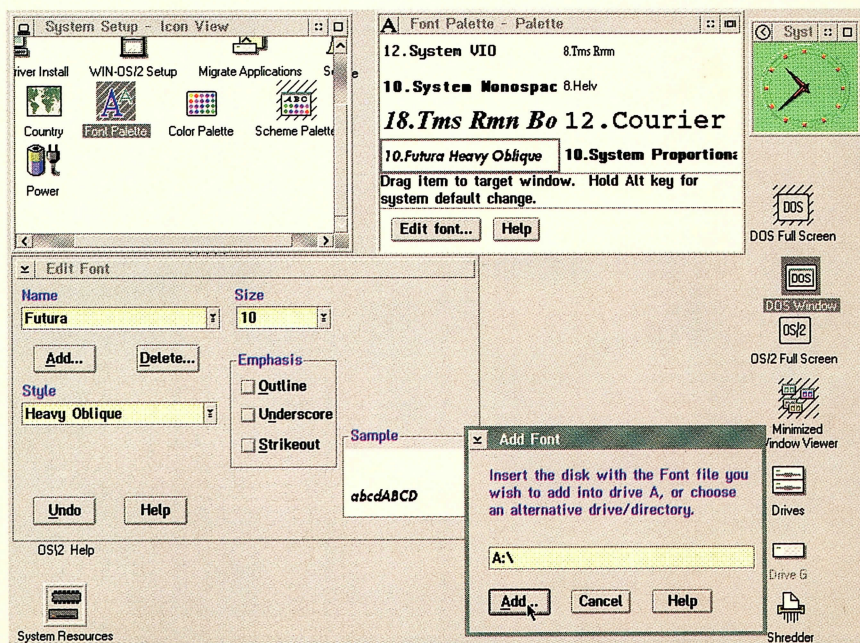


Figure 6: The Edit Font dialog box under the Font Palette allows you to install new Adobe Postscript fonts to the OS/2 Desktop.

Listing 1: *wauto.bat*, which could be (stored in *\os2\mdos\winos2* directory).

```
@ECHO OFF
ECHO.
PROMPT $!$P$G
SET DELDIR=C:\DELETE,512;D:\DELETE,512;
SET TEMP=G:\OS2\MDOS\WINOS2\TEMP
PATH= C:\OS2;C:\OS2\MDOS;C:\OS2\MDOS\WINOS2;
D:\PAGEMAKR;D:\ALDUS
c:
cd \fax
casmgr casmgr.cfg
```

the desired color for Shadow Text, click the Solid Color box, and close the Edit Color and Edit Scheme windows (see Figure 5). You can now drag the New Scheme icon to any part of the desktop, and the color of text for shadow icons will change to the one you've selected. If you hold down the <Alt> key while you drag, the changes you've made will be applied universally. You can use the Schemes Palette to store a series of color and font changes to apply to the desktop. The original fonts and colors can be restored if you drag the Default Scheme to the desktop while holding down the <Alt> key.

The Font and Scheme Palette tools can also be used to add Adobe PostScript fonts to OS/2 applications after OS/2 has been installed. If you have Windows or DOS desktop-publishing programs on the system, their font files are probably stored in a directory called *\psfonts*. For OS/2 to display and print these fonts, two files are necessary: the *.pfb* font outline and the *.afm* metrics file. (Windows and Win-OS/2 use a third file with the *.pfm* extension.)

To make the Workplace Shell recognize additional Postscript fonts, locate the *.pfb* and *.afm* files for each font. (These will be on your original Adobe font disk. You may also have an AFM directory on your hard disk.) The *.pfb* and *.afm* files must be in the same directory so that OS/2 can install them. Open the Edit Font dialog in either the Font Palette or

the Scheme Palette and select Add (see Figure 6). Type in the drive letter or directory where the *.pfb* and *.afm* files reside. A dialog box will pop up with a series of filenames. Click on the *.afm* filenames for the fonts you want to install, then select Add. (If you get a message that says OS/2 can't copy the files, you may have to copy the *.pfb* and *.afm* files to the same directory first.)

If you have PostScript fonts installed for Windows 3.1, but don't

have their accompanying *.afm* files, it is possible to generate this missing data with a free utility called *pfm2afm*, available on IBM's OS/2 BBS and on CompuServe. *Pfm2afm* makes use of information in the Windows font-metric file. Since the Windows font metric is sometimes incomplete, this utility generates OS/2 screen fonts of varying quality. (Commercial Windows-based font-management products such as Atech's Alltype and Ares' Fontmonger can also be employed to read a PostScript outline and produce more complete *.afm* files for OS/2.)

If you have additional PostScript fonts that you would like to install for Windows applications, you must open a full-screen Win-OS/2 session and run OS/2's version of Adobe Type Manager.

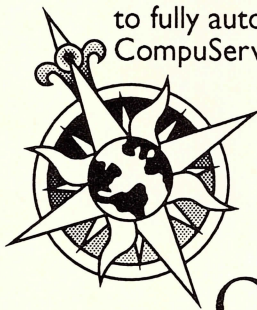
Lenny Bailes is a writer, teacher, and consultant in the San Francisco Bay area. He can be reached via CompuServe as 70713,562.

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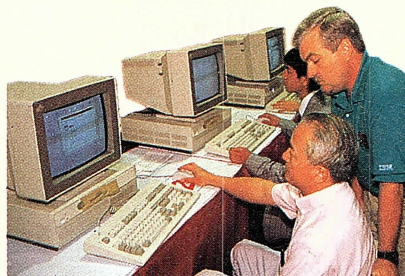
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OMOS2

The Esther Utilities

A LOOK AT EIGHT ESSENTIAL TOOLS FOR YOUR OS/2 DESKTOP BY ESTHER SCHINDLER

Software utilities are specialized applications. They do only one thing, but they do it exceptionally well. The features in a utility often sound dull, but they make it possible for you to work a little better—and *that* can be exciting. There isn't room to describe all of the good OS/2 utilities available, but I'll share with you a few that I think are vital. Even at the most desperate of hard-disk cleanup sessions at the Schindler's, these applications are *never* in danger of being deleted.

The first three utilities I describe are, in my opinion, absolutely essential. I can't imagine using a computer without them. Without 4OS2, DeskMan/2, and the GammaTech Utilities, the world would be a dull, drab place, without substance or meaning. Then, I'll describe five simpler, but still important, utilities in less detail: EABrowse, EnveLogo, FlexText, FM/2, and System Colors.

4OS2

J.P. Software

The shortest definition of 4OS2 is a replacement for *cmd.exe* (which is the OS/2 equivalent of the familiar DOS command interpreter, *command.com*), but that description doesn't do the program justice. 4OS2, like its sister applications 4DOS and 4NT, enhances the command-line interface, making it a much more friendly place. Quite honestly, I've barely skimmed the surface of 4OS2. But, even as an occasional or lightweight user, 4OS2 is worth its weight in top-quality chocolate.

Using 4OS2, you can list, copy, delete, or move multiple files with a single command. You can optionally ask for confirmation for each file activity. 4OS2 has full-featured command-line editing, history, recall, and complete, context-sensitive, on-line help. 4OS2 enhances the OS/2 batch processor with sophisticated batch commands. 4OS2 provides aliases, which let you create new or shorthand variations on OS/2 commands without the need to create batch files. I use so many aliases that I've forgotten the syntax of the original commands.

While I'm still essentially a command-line kind of gal, that doesn't mean I *like* to type. And,

with a few hundred directories on my local and network hard drives, I don't necessarily remember how I spelled something. For example, without 4OS2, to change directories to *r:\writing\os2magazine* at an OS/2 command line, I would have to type:

```
R:<Enter>
CD \writing\os2magazine<Enter>
```

Using just the built-in features of 4OS2, all I have to type is:

```
cdd r:\W<Tab>\O<Tab><Enter>
```

4OS2 fills in the missing characters using a directory lookup, so I type fewer than half the characters. The

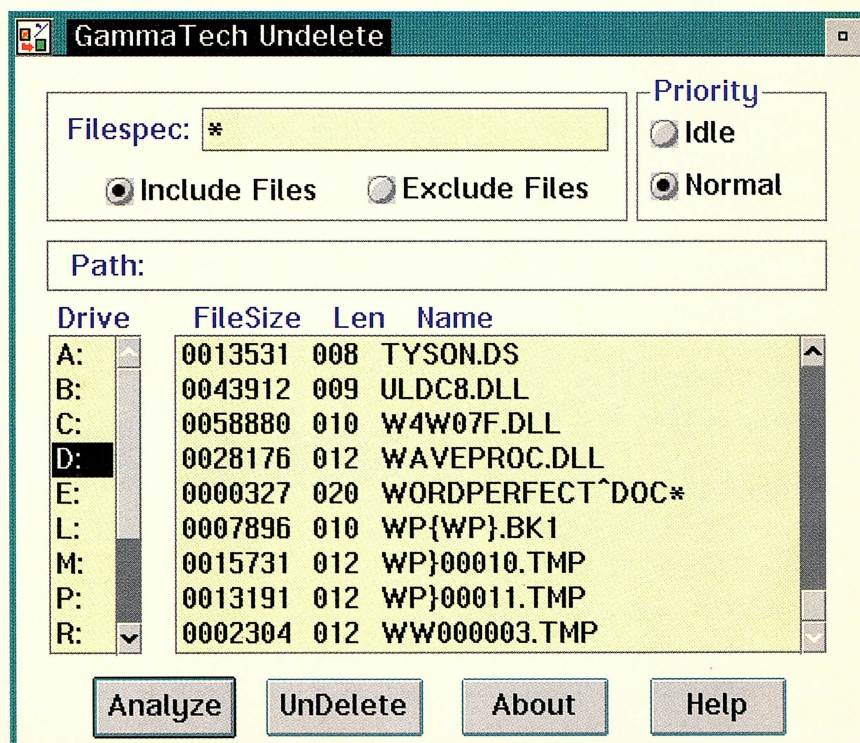


Figure 1: GammaTech includes a powerful file undelete utility.

Reviews

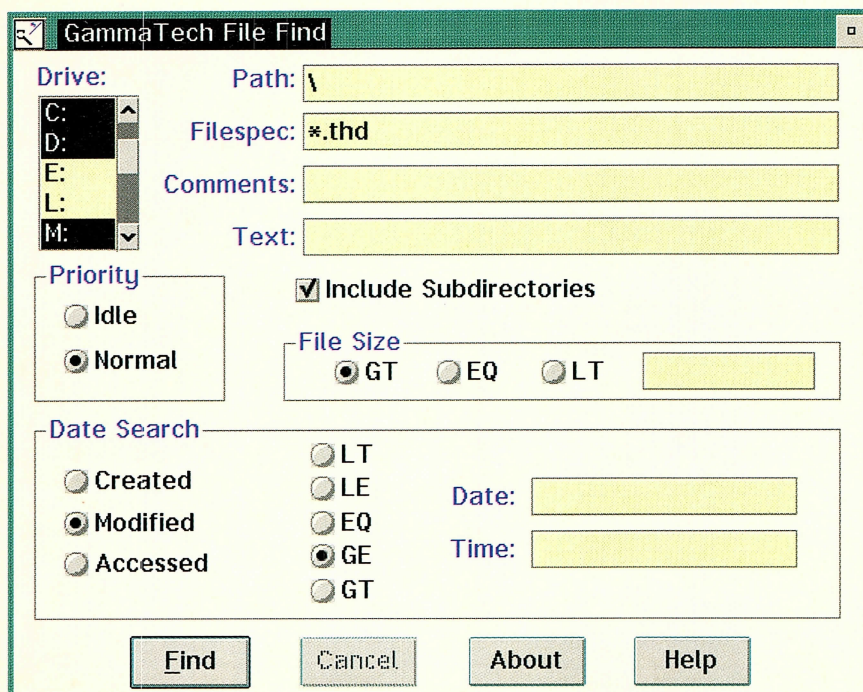


Figure 2: GammaTech's File Find Utility lets you search for files based on file dates and sizes, as well as file name and contents.

result is still `cdd r:\writing\os2magazine` on the command line, I just didn't have to type (or remember) as much.

You can use character lists and ranges in wild cards. Directories can be color-coded. For example, programs can be displayed in red, directories in green, and data files in bold white. This simple color-coding makes my system significantly easier to use.

Okay, so these features might not sound like the neatest things since pockets. But that's because you haven't tried them. Once you get used to navigating around your system with such a powerful tool, it's impossible to go back. 4OS2 demonstrates all the reasons that 4DOS won so many awards. There's no question in my mind that it's worth \$69. Don't take my word for it, though: 4OS2 is shareware, so you can download it from

CompuServe or from your favorite BBS. I'm certain that you won't be more than three pages into the manual before you reach for your checkbook.

GammaTech Utilities SoftTouch Systems Inc.

When the IBM-PC was new, I bought the Norton Utilities (now published by Santa Clara, Calif.-based Symantec Corp.) as an insurance policy. It was a sure bet that one day, I'd accidentally delete a file or do something else that was truly stupid. And, sure enough, Norton saved the day many times over.

I bought the OS/2-based GammaTech Utilities for the same reason. The only time I've ever really *needed* GammaTech was, naturally, the day before I bought it. (Fortunately, that occasion wasn't accompanied by the gut-wrenching realization that I had

just deleted my accounting system.) Since then, I have only needed to undelete a few files. However, I'm glad GammaTech is installed, because I like to know that I can save myself from the inevitable forthcoming disaster. But there's more to Softouch Systems' GammaTech Utilities than simple file recovery.

GammaTech will recover files from a damaged HPFS volume, allow you to display or edit disk sectors, or recover damaged files. If you're a computer novice, these tools may sound as if they're more technical than you will ever need—but if you need them on only a single occasion, you will be glad you listened to me.

All of the recovery utilities are accessible from the command-line. That's a strength because if you have an OS/2 emergency, you usually need to recover from a command prompt.

GammaTech also includes several useful utilities that enhance OS/2 on a day-to-day basis. For example, you can optimize (defragment) HPFS or FAT drives. The GammaTech System Info utility generates incredibly detailed reports about hardware and OS/2 system settings. OS/2's included Seek and Scan utility is limited, and won't print a list of the files it generates. GammaTech's File Find utility lets you do so, and it includes many more search options.

If you're a stand-alone user, you need GammaTech for all the reasons you have car insurance. If you support other OS/2 users, you need it to fight the havoc that they are bound to create.

DeskMan/2
Development Technologies Inc.
Have you ever reinstalled OS/2,

Reviews

then spent hours painstakingly rebuilding your favorite Workplace Shell (WPS) persona? If so, DeskMan/2 is worth the price just for the desktop backup insurance. DeskMan/2 uses the drag-and-drop interface to let you back up, restore, and migrate your WPS desktop quickly and easily. There's also a WPS image backup included that will configure, capture, and restore information related to the desktop. But DeskMan/2 does more than system backups.

You can use DeskMan/2 to share WPS objects with other users. For example, in one busy weekend, my company helped install 30 OS/2 workstations at one client site. We created one master system with the WPS setup just the way we wanted it, and then used DeskMan/2 to migrate that exact desktop to all 30 users. Not only did DeskMan/2 save a lot of time, but we *knew* that each system started out identically. The consistency was nearly as important as the time

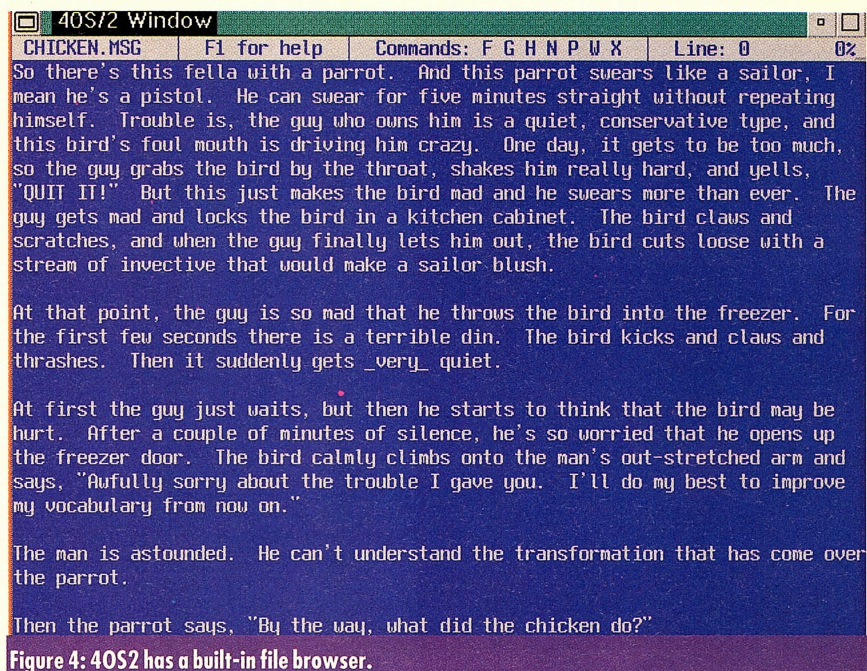


Figure 4: 4OS/2 has a built-in file browser.

savings.

Sometimes, OS/2's Shredder is recalcitrant about deleting certain objects. In particular, I've found that OS/2 has a fondness for printer objects, and refuses to part with

them. The *only* reliable way I have found to delete an OS/2 printer object is to use DeskMan/2.

DeskMan/2 is a great tool for the curious. You can query objects to learn about their settings. You can create REXX scripts to recreate an object. You can change an object's styles, temporarily or permanently.

The program is CID enabled, so it can be remotely installed and configured over a network. You can use DeskMan/2 to set up personal and standardized desktops. If a users log into the network from different computers every day, DeskMan/2 can automatically download their desktop to the current workstation. You can use DeskMan/2 create secure, undeletable, or unmodifiable objects. It's possible to set up a desktop that the user can't modify—an important feature in some offices, or in homes with children who think that the Shredder is a neat toy.

The newest version of DeskMan/2 includes a utility called VUEMan/2, which provides as

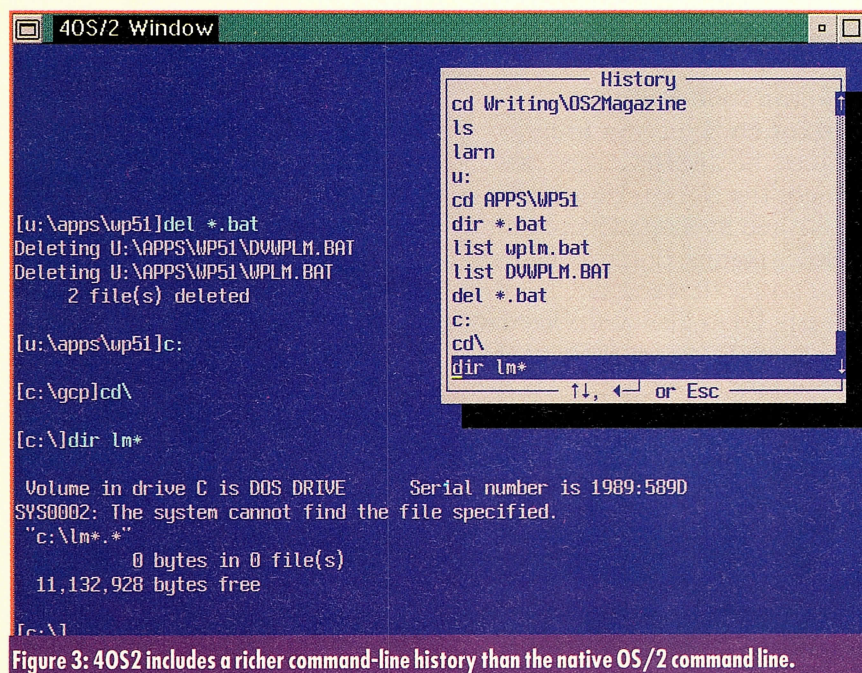


Figure 3: 4OS/2 includes a richer command-line history than the native OS/2 command line.

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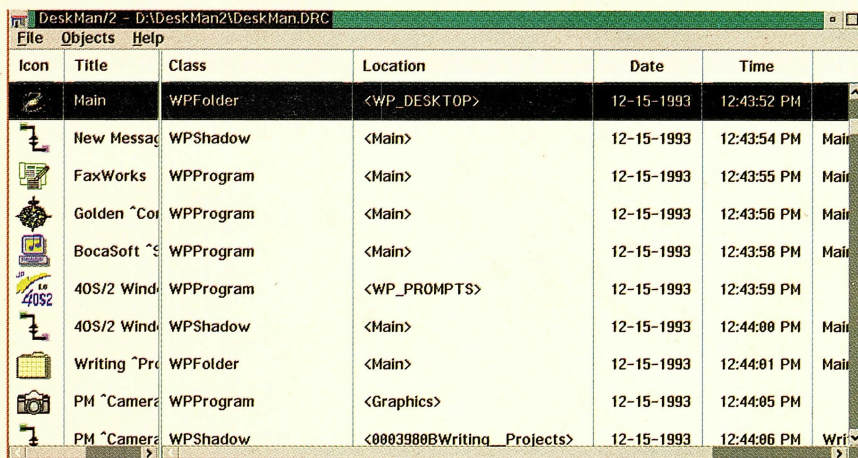
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Reviews



Icon	Title	Class	Location	Date	Time	
	Main	WPFolder	<WP_DESKTOP>	12-15-1993	12:43:52 PM	
	New Messag	WPSshadow	<Main>	12-15-1993	12:43:54 PM	Main
	FaxWorks	WPPProgram	<Main>	12-15-1993	12:43:55 PM	Main
	Golden ^Co	WPPProgram	<Main>	12-15-1993	12:43:56 PM	Main
	BocaSoft ^s	WPPProgram	<Main>	12-15-1993	12:43:58 PM	Main
	40S/2 Wind	WPPProgram	<WP_PROMPTS>	12-15-1993	12:43:59 PM	
	40S/2 Wind	WPSshadow	<Main>	12-15-1993	12:44:00 PM	Main
	Writing ^Pr	WPFolder	<Main>	12-15-1993	12:44:01 PM	Main
	PM ^Camera	WPPProgram	<Graphics>	12-15-1993	12:44:05 PM	
	PM ^Camera	WPSshadow	<0003980BWriting Projects>	12-15-1993	12:44:06 PM	Wri

Figure 5: DeskMan/2 saves every relevant bit of information about objects on your desktop.

forgotten what *futhr.zip* is, and where it came from. Since Golden CommPass (a CompuServe interface program from Creative Systems Programming in Mount Laurel, N.J.) stores the original file description, the file keywords, and download history in the file's extended attributes, EABrowse can help to remind me what the downloaded file contains. As more applications take advantage of OS/2's EA support, this tool will become increasingly useful.

EnveLogo JMP Systems

EnveLogo is a free utility that

many as 81 desktops on a single screen, or a desktop nine screens high by nine screens wide. Any PM window can be password protected, either by inclusion (only these windows are accessible) or exclusion (all but these windows are accessible).

EABrowse Hank Kelder

EABrowse is a free utility that

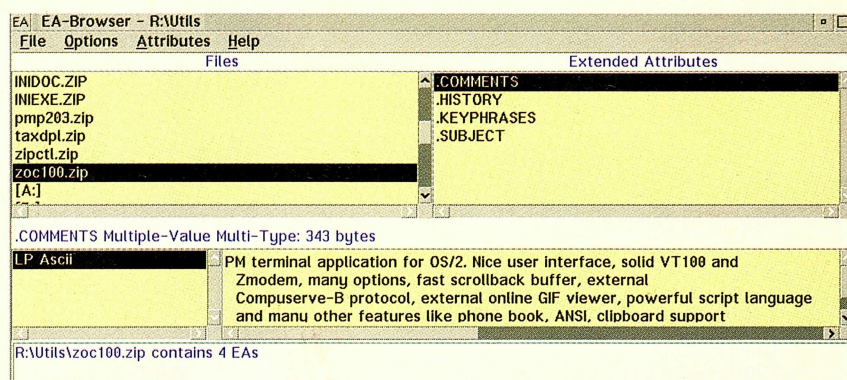


Figure 6: EABrowse displays the contents of files' extended attributes.

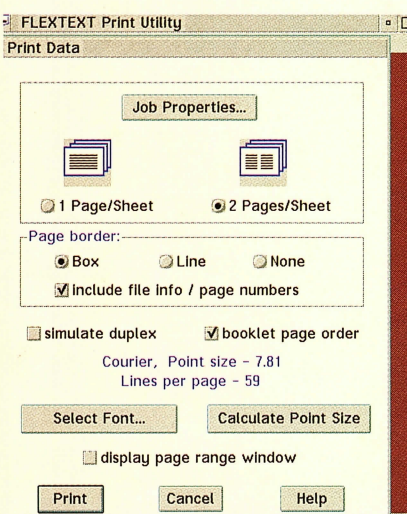


Figure 7: FlexText can print text files in portrait or landscape mode, with any OS/2 installed font, and can even create booklets.

enables you to review the extended attributes (EAs) of OS/2 files. Comparatively few applications take advantage of the EAs; among the few that do are WordPerfect 5.2 for OS/2 (which keeps the author's name, file description, and other items in the document comment field) and Golden CommPass.

I have been using EABrowse for a only few weeks, but it has already become indispensable. I download a lot of files from CompuServe, all of which are stored in a *\download* subdirectory. With CompuServe's 6.3 filename limitation, it doesn't take long before I've completely

prints envelopes. You can type data in directly or paste it from the keyboard. You can use graphic logos if you like, and set up custom templates. It's the fastest way I know to get an envelope printed from OS/2. EnveLogo comes with several default templates; the program is so straightforward that I've never needed to explore further.

FlexText Extension Software

FlexText prints ASCII text files in a wide variety of formats. You can print multiple pages per sheet in portrait or landscape mode, using

Reviews

any font installed on your system, in any type size. The program can automatically select the "best fit" for the data file, so that the text lines won't wrap. Both sides of the paper can be used even if you don't have a duplex printer; FlexText will prompt you to turn the paper over. You can also create two-up landscape booklets. It's an extremely useful shareware program, well worth the registration fee.

FM/2 M. Kines

I have never been a fan of disk-management tools, such as XTree or Norton Commander. FM/2 is a shareware version of that kind of program, and it's so good that it might change my mind about the entire product category. FM/2 is an excellent replacement for the OS/2 Drives object, which is... well, one of my least favorite parts of OS/2.

FM/2 provides a visual picture of your hard disk, and makes it easy to navigate your way around the system. It has readable icons that let you instantly change direc-

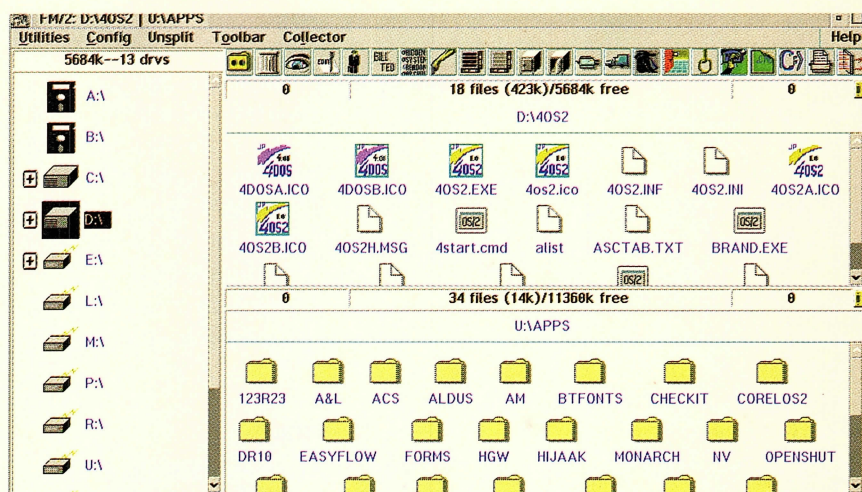


Figure 9: FM/2 provides tools to help you manage the files on your hard disk.

tories, modify the icon or date of an object, or delete, rename, or copy files. You can split the files window to view two directories at once. You can view or edit files, and associate files with programs. For example, you can configure FM/2 so that it will run OS/2's VIEW program when you double-click on an .inf file. You can also search for files with FM/2's own

version of Seek & Scan.

FM/2 is nicely integrated with the Workplace Shell. As one example, you create a copy of a file in the same directory by copy-dragging it onto a blank spot in the directory container.

System Colors Donna Campanella

OS/2's built-in Scheme Palette lets you create, maintain, and apply collections of colors and fonts for your OS/2 desktop. It has some limitations, however. With the Scheme Palette, you can't modify the color settings for every OS/2 object. Nor do I, personally, find it an easy tool to use. (For tips on getting by with Scheme Palette, however, see Lenny Bailes' article, "Desktop Tuning Tips," on p. 43-47 of this issue.)

SysColors is a shareware program that allows you to configure the colors on your desktop. It provides several predefined color schemes, and lets you create new ones. It lets you manipulate the color of absolutely every OS/2 object—or, at least, I haven't found one that it doesn't cover. Most

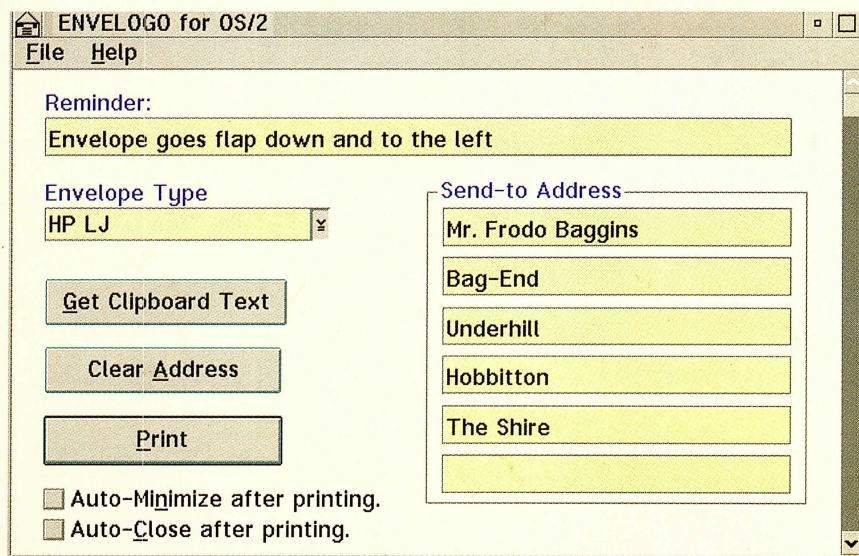


Figure 8: Envelope is a simple envelope printing program.

Reviews

color changes are visible immediately, so you can tell how your desktop will look. Colors can be set temporarily or permanently.

It takes a few minutes to get the hang of SysColors (being presented with a brightly colored rectangle is a bit disconcerting) but it's worth the time to learn. If you want a quick way to explore different desktop "moods," or if you want an easy way to standardize desktop colors in an office, this is a handy utility to explore. Besides, it has one of my favorite "reasons to register this shareware" messages: "If you use SysColors, please send a small donation of \$15.00 so that I can prove to my husband that all the long hours I spend with my PC instead of with him are really worth something."

That's just the tip of the OS/2 utilities iceberg—there are plenty more out there! My only problem with finding OS/2 applications and utilities is that I'm running out of disk space on which to install them.

Esther Schindler is a computer consultant who writes and teaches about computers. She is vice-president of the Phoenix PC Users Group, and co-coordinator of its OS/2 Special Interest Group. Esther is the primary sysop of the ZiffNet Executives On-Line forum, and an outspoken user advocate. You can reach her on CompuServe at 72241,1417.

RESOURCES

4OS2 (\$69, shareware; \$89 with 4DOS)

J.P. Software
P.O. Box 1470
E. Arlington, MA 02174 USA
(800) 368-8777 (USA only) or 617-646-3975
Fax (617) 646-0904.
Available on CompuServe's OS2USER forum in library 4 as 4os232.zip.
READER SERVICE NO. 167

DeskMan/2 (\$79.95)

Development Technologies Inc.
308 Springwood Rd.
Forest Acres, SC 29206-2113
(803) 790-9230
READER SERVICE NO. 168

EABrowse (free)

Available on CompuServe's OS2USER forum, library 4, as eabrws.zip.

READER SERVICE NO. 169

EnveLogo (free)

JMP Systems
RR #2
Orangeville, Ontario, Canada L9W 2Y9
CompuServe 76547,357
(519) 941-7550
Fax (519) 941-9046
Available on CompuServe's OS2USER forum, library 4, as envlgo.zip.

READER SERVICE NO. 170

FlexText (\$39, shareware)

Extension Software
921 W. Meseto Ave.
Mesa, AZ 85210
(602) 820-0321
CompuServe 74230,1620
Available on CompuServe's OS2USER forum, library 4, as fltxt.zip.
READER SERVICE NO. 171

FM/2 (\$35 personal, \$75 commercial use, shareware)

M. Kimes
542 Merrick
Shreveport, LA 71104
Available on CompuServe's OS2USER forum, library 4, as fm.zip.
READER SERVICE NO. 172

GammaTech Utilities for OS/2 (\$149)

SoftTouch Systems Inc.
1300 S. Meridian, Ste. 600
Oklahoma City, OK 73108
(405) 947-8080
Fax (405) 632-6537
READER SERVICE NO. 173

System Colors (\$15, shareware)

Donna Campanella
508 Natalie Ln.
Norristown, PA 19401
CompuServe 72010,2305
Prodigy KCTW07A
Available on CompuServe's OS2USER forum, library 4, as syscl2.zip.
READER SERVICE NO. 174

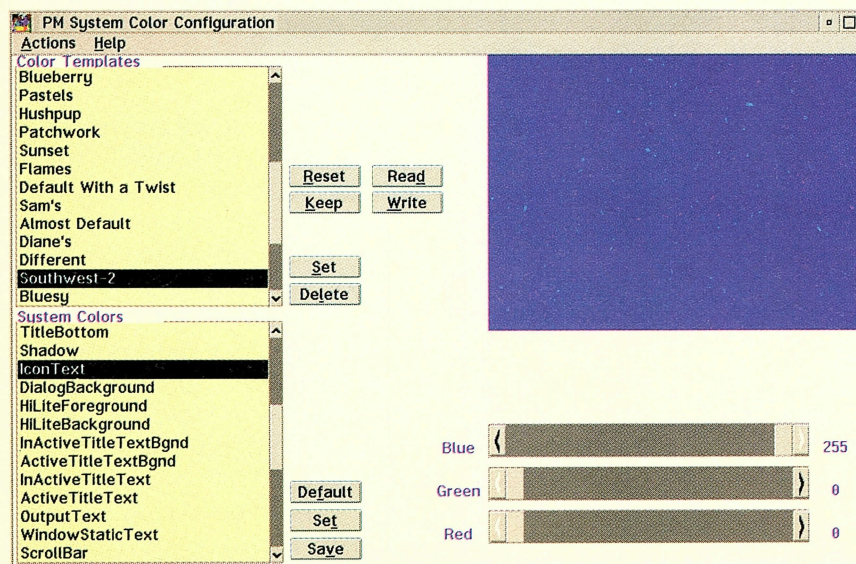


Figure 10: SysColors lets you modify the colors on 41 OS/2 objects.

**Late-Breaking
Developments in the
World of OS/2**

Just Announced

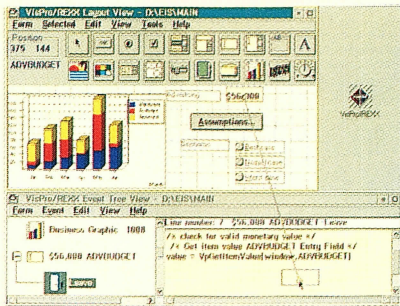
VisPro/REXX 2.0

Visualize your REXX code today

Hockware is announcing the release of two new versions of their VisPro/REXX visual REXX products. The Bronze version of VisPro/REXX includes new features such as the ability to write visual macros for REXX-aware programs, an SOM Toolkit, Q+E Database support, and an improved debugger. This version includes pop-up menus and OS/2-style help to programs created by the Bronze version. The high-end version, VisPro/REXX Gold, has all of the features of the Bronze version in addition to a Visual Database designer, MMPM/2 Video Window support, drag-and-drop support, and a circular slider object.

Suggested retail pricing for VisPro/REXX Gold 2.0 is \$299 and VisPro/REXX Bronze 2.0 is \$99. Special upgrade pricing is available until March 31, 1994 at \$39 for VisPro/REXX Bronze, and \$59 for VisPro/REXX Gold. Thereafter, upgrade prices will be \$59 and \$99, respectively. Hockware can be contacted at (919) 380-0616, or fax (919) 380-0757.

READER SERVICE NO. 175



computers from as far away as 500 feet and can be powered by either 110 or 220 volts AC. The connector is available directly from Network Technologies, and sells for \$2,579 with a one-year guarantee. For information, call (800) 742-8324, (216) 562-7070, or fax (216) 562-1999.

READER SERVICE NO. 177

Chron 4.0

Be on schedule every time

Hilbert Computing is announcing the release of Chron version 4.0 for OS/2. Chron version 4.0 is a 32-bit multithreaded Workplace shell application that will schedule OS/2, DOS, and Windows applications running under OS/2 2.x. Chron schedules reminder messages through its Workplace-shell-like interface. Scheduling options have been enhanced since prior versions and allow events to be scheduled in increments of minutes, days, weekdays, weeks, months or years. Chron version 4.0 also adds REXX macro language capability for more complex scheduling options. Chron version 4.0 is available for \$99 directly from Hilbert Computing or through resellers. For more information call Hilbert Computing at (913) 780-5051, fax them at (913) 829-2450, or e-mail through CompuServe at 73457,365.

READER SERVICE NO. 178

Ultimedia Mail/2

Yell at your coworkers from your desk

If you have a TCP/IP network running OS/2 and are interested in a multimedia mail product, IBM's Ultimedia Mail/2 (or UltiMail/2) allows users to send text, sound, and video messages as well as binary files over any TCP/IP network using SMTP and the RFC-822 and MIME formats. Other features include advanced message management, shared mail folders, access through SLIP, and dictation (using IBM Speech Client/2).

Ultimedia Mail/2 is a Workplace Shell program and requires OS/2 version 2.1 or greater and TCP/IP to function. The price for Ultimedia Mail/2 (part number 65G1249) is \$99 for the first license and \$89 for

each additional copy. For more information contact IBM at (800) 954-0144 or (914) 945-2316.

READER SERVICE NO. 176

SE-6M6M15V-8-ABMK-LOC

Control eight OS/2 Machines from one Keyboard

Network Technologies Inc. is announcing the release of their SE-6M6M15V-8-ABMK-LOC controller. This switch allows a single keyboard, mouse and monitor to control up to eight OS/2 machines from a single workstation. The SE-6M6M15V-8-ABMK-LOC connector hooks up to a 15-pin high-density D cable the mouse and keyboard cables are connected via six-pin mini DIN. The unit can control

LinkTime Project Manager

Manage your workers better

Link II Inc. is announcing the release of LinkTime Project Manager, a client/server project-management

Just Announced

**Late-Breaking
Developments in the
World of OS/2**

tool with an OS/2 front end. Project-management Features include Auto-Assignment, AutoScheduling, and effective resource management by factoring skill levels into the assessment of job-completion time. This program also features standard project scheduling tools such as Gantt charts, Dependency Networks, and Critical Path Management. The ability to embed sound files into messages has been incorporated into this first release. It includes the LinkTime database, but does require that a database server be in place. Linktime Project Manager is available for an introductory price of \$149.95. After July 15, 1994 the price will be \$249.95. Link II Inc.

can be reached at (713) 446-0332 or (800) 243-6929.

READER SERVICE NO. 179

Track-It 1.2

Work schedules on-the-fly

UES Inc., Knowledge Integration Center is announcing an update to their KI Shell extension Track-It. The KI Shell is a work-flow management shell that runs on top of OS/2 and makes sure that tasks assigned are completed and shuttled to the right person. The Track-It extension allows for ad-hoc jobs to be assigned as they come up (and need to go through a

complicated set-up phase first.) This update improves the ability of the program to show relationships between tasks over time. Track-It is available on all KI Shell platforms including OS/2, RS/6000, and Sun HP9000. Prices start at \$400 per concurrent user. A migration path to full-function KI Shell is provided. UES-KIC can be contacted at (614) 792-9993, or through IBM Workflow Services.

READER SERVICE NO. 180

RightFax 3.5

LAN faxing courtesy of OS/2

RightFax, formerly known as RCracchio & Feder, is announcing the release of RightFax 3.5, a LAN fax server that runs under OS/2. The fax server converts print jobs sent out over a NetWare, LAN Manager, or LAN Server LAN into Group 3 code faxes. Rightfax features DOS, OS/2 Workplace shell, and Windows clients for both users and administration. The utility software includes automatic printing of received faxes, individual phone books for all users, and customizable cover sheets. Incoming faxes can be saved in either DCX, PCX or TIFF formats. Mail gateways are available for cc:Mail and Microsoft Mail. Now, version 3.5 also gives you the ability to send documents via Binary File Transfer (BFT) as editable text.

RightFax requires OS/2 1.3 or higher, a dedicated 386, at the least, with 12MB of RAM and an 80MB hard drive. Pricing starts at \$995 for unlimited users. Licensing is determined by the outgoing channels of the fax server not by number of users. You can call RightFax at (602) 327-1357 or fax at (602) 321-7456.

READER SERVICE NO. 181

Take control of your OS/2 scheduling needs with

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Version 2.0b

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Are you looking for a way to manage your production job streams? Do you have programs that need to run after the completion of one or more other programs? Do you want to process files that have just been received from another system or modified locally? Do you need to schedule around holidays and periods of heavy CPU load?

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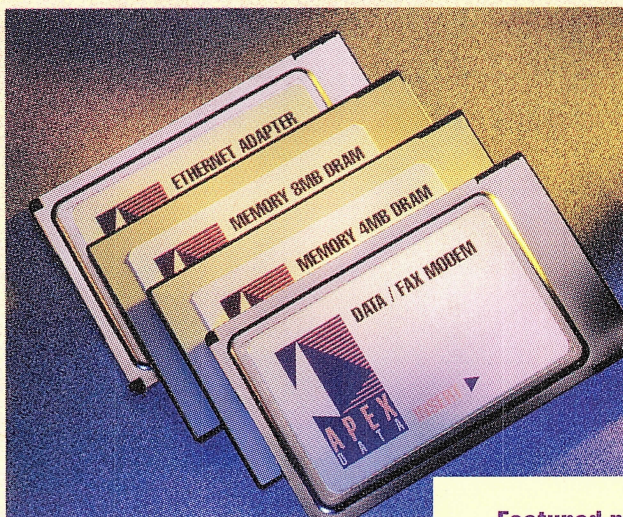
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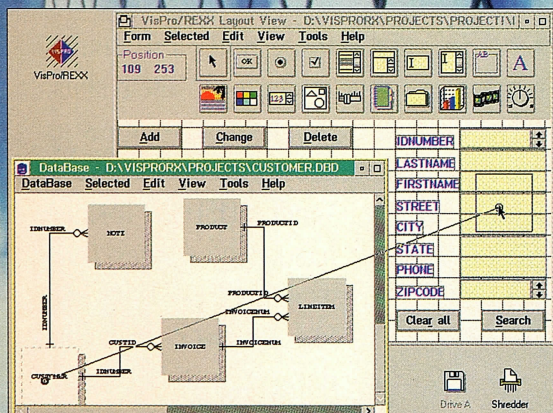
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For OS/2 2.x

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Reader Service No. 31

REXX Program Structure

HOW TO ORGANIZE YOUR PROGRAM BY ALEX LANE



In this column, we have thus far covered the three basic processing techniques (looping, branching, and sequential processing) and the use of functions. This month, we'll take a step back and look at the basic structure of a REXX program.

Clueless Code

The following REXX code outputs the value of the monthly payment for a loan of \$11,000 at an interest rate of 13.5% over a five-year period.

```
/* MONTHLY.CMD */
say 'The monthly payment is
$253.11'
exit
```

Not very impressive as a program, is it? As it stands, the code supplies the correct answer, but it's otherwise useless. Looking at the code, the output string looks like the answer to some question, but there's no indication of what the question might be, or how the answer was obtained. Of course, the missing information could be output the same way the answer is, but the result would be of scant use because you couldn't change the interest rate or the amount or term of the loan without essentially rewriting the whole program.

Improving the code

The code in *monthly.cmd* is, of course, an extreme example of inflexible coding. To better solve

**We'll take a
step back and look at
the basic structure of
a REXX program.**

the stated problem, we can write a more useful program as shown in Fragment 1.

This straightforward code uses some numbers to perform a calculation, and outputs the result.

(FORMAT is a built-in REXX function whose operation is explained in the sidebar on pp.62.) The output of this code is shown in Fragment 2.

This program is vastly improved over the original. For one thing, it starts with a set of initial data (the loan amount, interest rate, and term), performs a calculation using a formula, and outputs an answer. (In the formula, by the way, the '**' operator denotes exponentiation.) These three steps—input, processing, and output—form the basic structure of virtually all programs.

Fragment 1:

```
/* MONTHLY1.CMD */
prin = 11000 /* amount borrowed */
int = 13.5 /* interest rate */
yrs = 5 /* number of years */
i = int/1200 /* monthly interest as a fraction */
n = yrs*12 /* no. of payments */
/* payment (pmt) is amount borrowed (prin) times equal-payment-
series capital-recovery factor */
pmt = prin*((i*(1+i)**n)/((1+i)**n-1)) /* output initial data
and results */
say 'For $'prin 'borrowed at' int'% for' yrs 'years,'
say 'the monthly payment is $'FORMAT(pmt,,2)
exit
```

Fragment 2:

```
For $11000 borrowed at 13.5% for 5 years,
the monthly payment is $253.11
```


The comments in the code help you to understand what the program is doing. Comments are important, not only for others who may look at your code, but for you, the author, as well. Code that may be intuitively obvious when you write it today may have you tearing out your hair six months from now, unless you've taken the trouble to insert comments.

Another common-sense feature of the code is the output of the initial data along with the answer. In addition to the obvious benefit of grouping the "question" and the "answer" together, viewing the initial data also helps catch errors (for example, entering an interest rate as a fraction [.135] instead of a number [13.5]). By editing the first three lines of the code, you can plug in different values for the interest rate and the amount and term of a loan and find the corresponding value of the monthly payment. As an alternative to editing the code, the program can be made more flexible by prompting the user to enter the needed information. For example, you can replace the first three lines of code with the code shown in Fragment 3.

The program can be further enhanced by checking the user's input to make sure, for example, that all three entries are numbers, or by outputting a line or two prior to the prompts stating the purpose of the program. You can probably think of some other enhancements, such as allowing the user to specify different interest periods (daily, monthly, quarterly), and so on.

A word of caution, however: Don't overdo it. One aspect of writing programs that is universally true is that you can always add another feature to make the beast more flexible. However, programs that suffer from such "featuritis" tend to eat a lot of development time, increase debugging time, and

The FORMAT Function

Using format in the *monthly1.cmd* program, if you were to output the value of the variable *pmt* (denoting the monthly payment) using the following line of code:

```
say 'the monthly payment is $'pmt
```

Your output would look like this:

```
the monthly payment is $253.108306
```

This presentation of the output is pretty ugly, since we're accustomed to seeing sums of money expressed to only two decimal places. The built-in REXX function *format* used in the code in the main text rounds off and formats the value of *pmt* to 253.11. The most commonly encountered form of a call to the *format* function contains two or three arguments. The first argument is the number to be formatted. The second argument specifies how many characters to use for the integer part of the number, and the third argument specifies how many characters to use for the decimal part of the number. (In the number 253.108306, 253 is the integer part of the number and is three characters long, and 108306 is the decimal part of the number and is six characters long.) If the second argument is smaller than the integer part of the number to be formatted, an error will occur: If it is larger, the number will be "padded" with spaces on the left. For example:

```
FORMAT(32.145,1) -> <error>
FORMAT(32.145,2) -> '32.145'
FORMAT(32.145,3) -> ' 32.145'
FORMAT(32.145,4) -> '   32.145'
```

If the third argument is not the same size as the decimal part of the number, the number is either rounded or extended (with zeros). For example:

```
FORMAT(32.145,,4) -> '32.1450'
FORMAT(32.145,,3) -> '32.145'
FORMAT(32.145,,2) -> '32.15'
FORMAT(32.145,,1) -> '32.1'
```

Note that omitting the second argument results in the use of as many characters as needed to express the integer part of the number being formatted. The *format* function can also be used to control the exponent part of a number, but that's beyond our scope here. If you're interested in learning more about *format*, please refer to the on-line REXX information in the file *rexx.inf*.

Fragment 3:

```
say 'Enter loan amount'
parse pull prin
say 'Enter interest rate (as a number)'
parse pull int
say 'Enter number of years to pay off loan'
parse pull yrs
```

eventually cross the barrier from being easy to use to actually being harder to use owing to the number of features.

Moving past formulas

The code in Fragment 1 illustrates the basic structure of a program—

you start with some data, do something to it, and finally deal with the result. We already have a good handle on the first part of the process; we can embed the initial data in the file or prompt the user for it interactively. We can also handle the results of processing, by displaying

output on the screen. While these are not the only methods of dealing with data input and output, they are adequate for now, while we discuss the processing part in more detail.

The middle part of *monthly1.cmd* is quite simple—plug numbers into a formula to calculate an answer. But what if we also wanted to output an amortization schedule that shows, month by month, the principal and interest paid, as well as the remaining balance on the loan? To do this, we have to identify the steps that must be performed to do the job.

To be able to create an amortization schedule, we need to know the monthly payment, and our existing code takes care of that. To actually create the schedule, we want to do a set of calculations repetitively, so we'll use a **do** statement. For each month, we'll calculate the interest on the remaining balance. The difference between the monthly payment (which we've already calculated) and the month's interest will give us the principal paid for the month. Finally, we'll subtract the principal from the remaining balance in preparation for the next iteration of the **do** statement.

Since we're interested in outputting intermediate results, we'll have a **say** statement that outputs the appropriate information once per iteration after all the calculations.

What variables correspond to what parts of the output is fairly obvious, except perhaps for the month number, for which we'll use the index of the **do** statement.

Before we start iterating, we'll output a line of text with headings for the month number, principal paid, and so on, followed by a line of hyphens. Although it's not necessary for our purposes, we'll also preserve the value of the amount borrowed (**prin**) by copying it into

Interactive REXX

Often, you might want to type in a few lines of REXX code to better understand how something works (such as the format function), but you're not excited at the prospect of firing up a text editor, entering the code, saving your work as a REXX .cmd file, and finally running the file before seeing any results. If that's the case, then *rexstry* is for you! *Rexstry* is a REXX .cmd file that lets you interactively try REXX statements from the OS/2 command line. After typing *rexstry* at the command prompt, you're presented with a few lines of explanatory output, and a blank line for entry of REXX code. Code is executed on a line-by-line basis. Typing in the line <call tell> outputs a screen of *rexstry* features. For example, entering <=> re-executes the immediately preceding statement, while typing in the line <call show> displays the user variables provided by *rexstry*.

If you want to save your input in a text file, such as *test.cmd*, so you can refer to it later, you'd enter the line <save=test.cmd>. To stop, you'd enter <save=""> (" is made up of two single quote marks and denotes an empty string).

A side benefit of *rexstry* is the fact that it is itself a REXX .cmd file, and a good example of commented, structured coding in REXX.

Fragment 4:

```
say 'Month   Principal   Interest   Balance'
say '-----'
bal=prin      /* copy value of principal */
do j=1 to 60
  pmtI = bal*i      /* interest part of payment */
  pmtP = pmt-pmtI /* principal part of payment */
  bal = bal-pmtP /* remaining balance */
  say FORMAT(j,4) FORMAT(pmtP,9,2) FORMAT(pmtI,10,2)
  FORMAT(bal,10,2)
end
```

another variable (**bal**), and then use that variable in the **do** statement. This is done in anticipation of possible future changes to the program, where the value of the initial amount borrowed may be needed after the **do** statement we've just introduced.

By identifying the exact steps by which the process is carried out, we've defined an algorithm for solving our problem. Some algorithms, such as the one we've just developed, have very specific uses; many others (such as algorithms for sorting data) are generic and can be used in many places. We'll talk more about algorithms in future columns.

The code corresponding to our algorithm is shown in Fragment 4,

and is inserted before the line reading **exit** in *monthly1.cmd*.

The gist

The basic structure of a REXX program consists of input, processing, and output. Algorithms define the exact steps to follow to perform the processing phase of a program. These steps are carried out using sequential execution, looping, and branching, in conjunction with calls to built-in and user-defined functions.

Alex Lane is a Colorado-based consultant and writer, and a contributing editor to Software Development magazine and AI Expert magazine. He can be reached via CompuServe as 75715,1370, or Internet as 75715.1370@compuserve.com.

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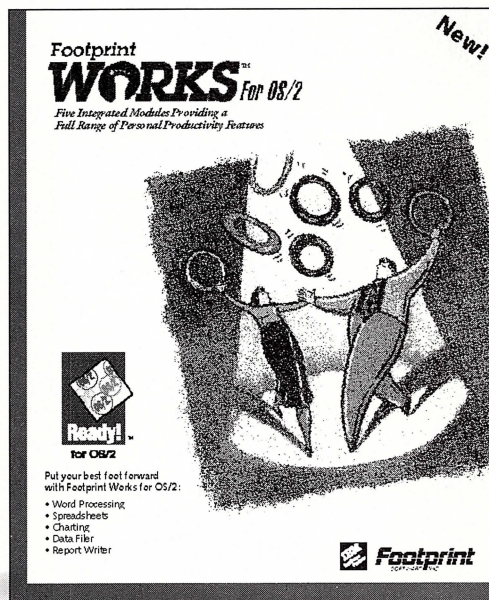
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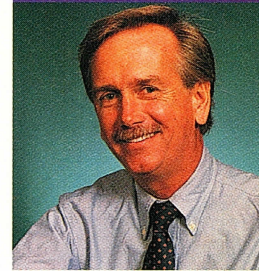
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OS/2 BBSs

A WAREHOUSE OF OS/2 SHAREWARE BY DICK CONKLIN



In the March issue, we introduced you to OS/2 user groups, many of which encourage the exchange of shareware and freeware among their members. This is usually done through electronic bulletin board systems (BBSs, or "boards"), which are open to members and often non-members alike. But other OS/2 BBSs are not club-affiliated, and you'll be surprised at the sheer volume of software and other items they have to offer. Space allows us to list only a few of the BBSs and a small fraction of the files available for downloading, but it's enough to get you started.

Thousands of OS/2 Files

The file libraries are the most popular hangouts on an OS/2 BBS. That's where you'll find thousands of contributed files, ranging from a few hundred bytes to several megabytes in size. You'll find ready-to-run application programs such as the popular Terminal Emulator/2 (TE/2) communications program. Programmers will find development tools, source code, and technical papers in the form of text files. There are device drivers supporting popular hardware such as CD-ROMs and high-resolution displays, and patches to fix bugs. Photos and drawings are available as image files, suitable as background wallpaper for your desktop. There are some interesting games,

**You'll be
surprised at the sheer
volume of software and
other items BBSs have
to offer**

some of which exploit OS/2's advanced multimedia features.

Be sure to browse the utility programs. Sean Purcell's File Commando is similar to the Windows-based Norton Commander. There are dozens of bit map (image) viewers, alarm clocks, screen savers, Adobe type 1 fonts, editors, shells, benchmarks, session monitors, and thousands of icons.

Most shareware programs ask for a small payment as compensation to the author, if you are going to use them. Registration may qualify you for additional features, updates and support. Lookout Mountain Software, creator of NISTP, a utility that calls the National Institute of Standards and Technology clock and updates your system clock with the precise time, doesn't ask for money, instead, they suggest a \$10 donation to either

the National Multiple Sclerosis Society or the American Red Cross.

Most bulletin boards allow free limited access. However, the larger systems often ask for a small contribution to help offset the costs of operation. Making a support contribution will usually increase daily on-line time, allow more downloads each day and/or access to additional BBS features.

Even text files can be helpful, such as the OS/2 Netware Requester documentation, the list of support phone numbers, OS/2 for Windows questions and answers, performance tuning suggestions, IBM's *Developer Support Newsletter* and a list of OS/2-related news clippings. Many books and product help documents are distributed as ready-to-print PostScript files, with imbedded font and format commands that produce a finished document on a Postscript printer. Others are created as .inf files that can be read on-line using OS/2's View command.

And of course, many of the files are more commercial in nature, such as the configurator and pricer for the IBM PS/2, an ad for the GENIE OS/2 Roundtable, a demo version of Arcadia's Workplace Companion personal information manager, and many more.

I took a break from writing this column to browse Pete Norloff's popular OS/2 Shareware BBS—the

world's largest. Figure 1 is a list of the 15 most frequently downloaded files (taken from the Download Hit Parade bulletin), a good popularity indicator.

A Place to Meet Other OS/2 Users

As with most BBSs, OS/2 boards provide several conferences or forums where users can read and reply to messages on a variety of subtopics. Some of the conferences are linked to BBS networks like Fidonet, IBM NET, OS2NET, and USENET, where messages are routed to and from other BBSs around the world. Don't be surprised if your question is answered by an OS/2 user in Australia! There is even a link between Fidonet and the growing Internet network used by colleges and corporations. Did

you miss last month's discussion in your favorite conference? Download its message archive file and catch up on what's new.

Getting Started

If you've never tried a BBS, don't put it off any longer. You'll need a modem, a communications program, and a BBS telephone number. If you're calling an out-of-town board, you can save long distance charges by calling after 11:00 pm or on weekends. You'll be prompted to register yourself the first time you sign on. Menus will guide you through the various services and features.

You'll also need a program to unzip (or decompress) the many zipped files you'll want to download. BBSs store most of their files in the .zip format to greatly reduce storage space and downloading

time as well as to group the many components of a software package into a single file. Several OS/2 versions of the DOS *pkunzip.exe* program are available. Ask a friend or someone at your local OS/2 user group to introduce you to BBSing.

Some Popular OS/2 BBSs

We've listed a few popular OS/2 BBSs in Figure 2. Over 100 boards are listed in the frequently-updated OS2WORLD file maintained by Dave Fisher, system operator (sysop) of the LiveNet OS/2 BBS.

The busy OS/2 Shareware BBS in Fairfax, Va. currently has 12 incoming phone lines handling over 23,000 calls and 37,000 downloads each month from a library of more than 6,300 files. 6,300 active callers in 35 countries participate in 55 message forums. Thanks to OS/2, it all runs on a single PC.

Figure 1: OS/2 shareware BBS: top downloaded files

File area 26	<i>21disk.zip</i>	Fixes several pervasive disk problems
File area 4	<i>sio120.zip</i>	Ray Guinn's high performance serial drivers for OS/2, version 1.20.
File area 13	<i>aplus.zip</i>	This is a popular OS/2 desktop bitmap. "OS/2" in raised white letters on a white background. (640x480x256).
File area 14	<i>cache.zip</i>	How to adjust your CACHE and DISKCACHE statements for improved system performance.
File area 14	<i>video2.zip</i>	A personal assessment of the merits of the current crop of video accelerator cards with emphasis on OS/2 2.1 support.
File area 14	<i>21sp.zip</i>	Installation instructions and <i>readme</i> file from the OS/2 2.1 service pack beta. Includes very brief notes about the 500+ fixes included as well as notes on additional support for CD-ROM drives and video adapters.
File area 4	<i>siobeta.zip</i>	Ray Gwinn's latest SIO beta V1.21J.
File area 1	<i>peg003.zip</i>	The most comprehensive resource monitor for OS/2 2.X. Pegasus resource monitor version 1.0 release 3. C.O.L. Systems Inc.
File area 3	<i>kwq12d.exe</i>	KWQ Mail/2, Version 1.2D. 32 bit QWK mail reader for OS/2.
File area 25	<i>iconset.zip</i>	A collection of bright, attractive icons for OS/2.
File area 1	<i>csed11.zip</i>	OS/2 system configuration editor; Simplifies the editing of <i>config.sys</i> and <i>autoexec.bat</i> .
File area 9	<i>unz501.exe</i>	32-bit UnZip utility for OS/2 2.X (freeware). 32 bit version of project Information-Zip's UnZip de-archiver.

The IBM Personal Computer Company board is another good place to start. In addition to shareware, you can find the latest information on OS/2, its applications, and IBM hardware.

And There's More

If you aren't completely overwhelmed by the gigabytes of files on OS/2 BBSs, there's more. You

can find more OS/2 shareware on on-line services such as Prodigy, CompuServe, and GENIE as well as on CD-ROMs, which distribute much of the same software on convenient compact disks.

Acknowledgment

Special thanks to Pete Norloff, sysop of the OS/2 Shareware BBS, who has helped thousands of OS/2 users and

provided a real service for all of us. Pete can be reached on his BBS at (703) 385-4325, Fidonet 1:109/347 and 1:109/357, or on CompuServe at 70324,2146.

Dick Conklin is a Contributing Editor to OS/2 Magazine and Editor-in-Chief of OS/2 Developer magazine, both publications of Miller Freeman. He has been BBSing for 12 years.

Figure 2: Some Open Access OS/2 BBSs

OS/2 Shareware BBS	Fairfax, VA	(703) 385-4325
IBM Personal Computer Co. BBS	Raleigh, NC	(919) 517-0001
LiveNet OS/2 BBS	Tulsa, OK	(918) 481-5715
Fernwood BBS	Branford, CT	(203) 483-0348
OS/2 Connection BBS	La Jolla, CA	(619) 549-4215
Greater Chicago On-line BBS	Chicago, IL	(708) 895-4042
Oberon Software BBS	Mankato, MN	(507) 388-1154

A current worldwide list of OS/2 BBSs can be found on the above boards as the file *os2world*. The original and latest version can be found on the LiveNet BBS.

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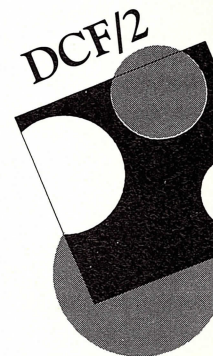
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Power Management *cont'd from p. 76*

As long as a system supports the APM standard, OS/2 will use it to help you get the most out of your laptop battery. You will see a Power object in the System Setup folder if OS/2 recognizes the APM BIOS in your system. If you are looking for a system to use, you may want to choose one that supports APM to get more use out of a battery change.

INHIBITING PARAMETERS

Q: Sometimes, when I set up new program objects I get some strange messages about paths not being found, but things seem to work fine anyway. What's going on?

A: Depending on how you set up the program object and how you invoke it, the Workplace Shell passes the name of the desktop as a parameter when the object is opened. You can tell the shell to ignore this parameter by placing a percent sign in the Parameters field in the object settings. The percent sign will inhibit any parameters from being passed to the program when the object is opened.

PARAMETER PROMPTING

Q: Thanks for the percentage in the program parameters, (*OS/2 Magazine*, February, pp. 82-84) are there any others that might be useful?

A: Quite often you may have a program that, if invoked via a command line, would take a file name as a data file to open. An example is an editor such as the System Editor. The way the System Editor program object is set up (at least initially by the system installation program) is such that when you open it, no file is initially loaded. You would then have to open the file you wish to edit. You can make this procedure easier with a parameter in the program object.

If you place a file name in the parameters field of the System Editor object, you would always open it up editing that one file. There is an easier way to edit any file you want, and specify it at the time you open the System Editor.

If you place a question mark in the parameters field of any program object, the shell will display a window asking for the value of the parameter whenever the object is opened. When you enter the value such as a file to be edited, it will be passed to the program being started.

POSTSCRIPT PRINTING

Q: I just purchased this new Postscript printer. I hooked it up on LPT1 where my other printer was, and installed the Postscript printer driver and connected it to LPT1 as well. I tried to test it out by copying my *config.sys* file to it, but all that happens is that the buffer light blinks and the printer does nothing. I tried the PRINT command as well and the same thing happens. What's wrong?

A: A PostScript printer cannot print a plain text file the way a dot matrix can. A printer in Postscript mode only understands the PostScript data stream.

When you look at a PostScript file, it is a plain text file, just as *config.sys* is. The difference is what the text says. A PostScript file is a program, and the PostScript printer has an interpreter built into it that understands, interprets, and executes the program. Your *config.sys* file, while it is a text file, is not a PostScript program, so the printer buffer light flashes signaling that it is receiving data, but then stops and throws it away because it does not know what to do with it.

If you have a PostScript printer and would like to print plain text (non-PostScript) files to it, you can use the drag-and-drop features of the Workplace Shell to grab the file object

and drop it on the printer object. You'll be asked if the file is a plain text file or printer-specific. If you say it is printer-specific, it will be passed through as if you used the COPY or PRINT commands. However, if you say it is plain text, the shell will pass it to the PostScript driver, which will turn it into a PostScript program the printer can understand.

MOUSELESS SHUTDOWN

Q: We have a server we don't often interact with and therefore have not attached a mouse. How can we shut down our system without the mouse?

A: Shutdown without a mouse is simple once you know the steps. The keys you use are the same as with any folder object, you just need to operate on the desktop, which is also a folder.

First, use <Ctrl-Esc> to bring up the Window List. Use the arrow keys to highlight the desktop window. Now hit the enter key to give it the input focus.

Next, hold down the <Ctrl> key and hit the backslash key. This will tell the desktop folder to remove focus from any particular object in the folder and give the focus to the folder itself.

Now, hold the <Shift> key and hit <F10>. This will bring up the context menu for the desktop folder. Now, cursor down to the Shutdown item and hit the enter key.

Note that the keys used in this procedure can be used on any folder, it's just that no other folder has a Shutdown item on its context menu. That's one of the advantages of the OS/2 Workplace Shell, the consistent behavior of all objects of the same class, in this case folders.

TRICK KEYS

Q: I often have many windows all over the desktop which makes

maneuvering to move, hide, and minimize them cumbersome. Are there any fast paths to manipulating windows?

A: You can hide windows directly from the Window List. Use <Ctrl-Esc> to bring up the Window List, then either use the arrows or the mouse to highlight the window(s) you want to hide. (Notice that you can use this technique on more than one window at once.)

With the window(s) highlighted, point to the highlight with the mouse and while holding down the <Shift> key, double click with the mouse, to hide the highlighted window(s).

To bring the windows back, do just as you would if they were minimized or obscured by others; double click on it in the Window List, or cursor to it and hit the <Enter> key.

MEMORY MAPPING

Q: I have 24MB of memory in my system. I've heard that OS/2 does not use memory above 16MB. Does it? If so, how?

A: OS/2 will use as much physical memory as you have in your system. How it makes use of the memory above 16MB depends on the hardware architecture of your computer.

OS/2 2.x uses the first 16MB in all computers as direct paged memory—primary storage. If the system has more than 16MB, some extra checking needs to be done as to how the hardware can address this memory. OS/2 takes action accordingly.

When OS/2 2.x boots, it queries the hardware as to how much total system memory is present. If it has 16MB or less, the memory is mapped to pages. If it has more than 16MB, the system asks the disk controller if it understands 32-bits. If so, all the memory above 16MB mapped to pages in the page tables.

If the disk controller does not understand 32-bits, (say, if it is a 24-bit controller) then OS/2 will map that memory to swap file number one. In other words, if the disk controller cannot address the memory 32-bits at a time, OS/2 will use the memory above 16MB as a dedicated RAM disk, specifically for swap space. When data needs to be written to the swap file, the swapper will write the data to this memory first, and then to the physical hard disk if this space becomes full.

One other item of note: when looking to see how large your swap file is, the size shown when doing a DIR of the swap file does not include the data in "swap file number one." If you know how much memory you have above 16MB when your disk controller does not understand 32-bit programs, you can add extra memory to the size of the hard disk swap file to get an approximate amount of data currently swapped out.

OS/2 APPLICATION SOURCES

Q: I know that OS/2 runs just about all of the DOS and Windows applications. Where can I find out about OS/2-specific applications?

A: You can go to several places to find out about what OS/2-specific applications are available and where you can buy them. I will not recommend any specific place to buy these applications, but will provide several alternatives. The choice is up to you.

First, you can find out about what OS/2-specific applications are available from CompuServe (or other BBSs that have these files in their libraries). The first file is *appos2.zip*, which is a file that is a simple list of OS/2-specific applications. It is incomplete (as is any list of this type—new applications are always coming out) so look for

the latest version. This file can be found on CompuServe in library 17 of the OS2USER forum as well as other BBSs.

Another file that is very useful is *tinfn.zip*. This file also describes OS/2-specific applications, however, it is in INF format. That is, you can view it using the *view.exe* tool that comes with OS/2, just as if you wanted to view the on-line command reference. This file also includes the software vendors' address and telephone numbers. It is also on CompuServe in library four of the OS2USER forum as well as BBSs.

You can also find out about OS/2-specific applications from vendors, such as IBM Sales, The Corner Store and Indelible Blue Inc. Each can help you find OS/2-specific applications that meet your needs.

David Reich has been with the OS/2 development team since 1987. He has written numerous articles for the OS/2 Developer and is the author of Designing OS/2 Applications (Wiley and Sons, 1993). Questions can be addressed to David via CompuServe at 76711,632 and via the Internet at speedracer@vnet.ibm.com.

RESOURCES

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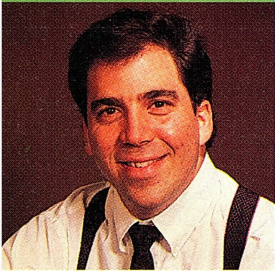
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The polite way to interrupt

INTERRUPTS, POSTSCRIPT PRINTING, MEMORY MAPPING **BY DAVID REICH**

INTERRUPT SETTINGS

Q: I've heard a lot of discussion of IRQs, interrupt levels, and addresses of devices under OS/2. Does this have anything to do with why I had to change the settings of my printer and serial ports when I installed OS/2?

A: That's exactly the reason. DOS and Windows, essentially single-tasking systems using a simple input/output (I/O) model, didn't care too much about interrupt levels on these types of devices. Applications would simply perform I/O on the port. Much of the work was the burden of the application.

OS/2 presents a consistent interface to applications that use devices. One of the functions of OS/2 is to use interrupt-driven I/O as opposed to the polling done in DOS and Windows. This enables efficient multitasking and OS/2 device drivers handle this work. As such, OS/2 requires interrupt settings on these devices to be set properly, and is not as tolerant as DOS when conflicts exist.

IRQ is another name for an interrupt level. The PC architecture provides for 15 interrupt levels in a system, which are the devices' way of letting the processor know who needs attention. Some levels are "reserved" for specific use such as the system timer and the keyboard. Others have been adopted as "stan-

**Some devices
come preset at the
factory with values
that will conflict with
existing devices.**

dard" by their use. Others are open for use by any other devices.

It is important when setting up your system, that you follow two basic rules—the first is not to have more than one device set to any single IRQ setting and the second is to try to follow the basic guidelines as follows:

- 0 System Timer
- 1 Keyboard
- 2 Secondary Interrupt Controller
- 3 COM2
- 4 COM1
- 5 LPT2
- 6 Diskette Drive
- 7 LPT1
- 8 Real-time Clock
- 9 Open
- 10 Open
- 11 Open
- 12 Aux Port (usually mouse)
- 13 Math Coprocessor
- 14 Hard Disk
- 15 Open

Some devices come preset at the factory with values that will conflict with existing devices. A good example of this is the SoundBlaster card, which comes preset at IRQ7. Nothing is inherently bad about this setting, DOS does not use IRQs the way OS/2 does, so DOS handles it just fine. But if you want to install a SoundBlaster in an OS/2 machine, you'll need to change the IRQ to say, IRQ10, because LPT1 uses IRQ7.

If you have just added an adapter, or are simply installing for the first time, check to be sure you have no IRQ conflicts. Because of the diversity of hardware in the market, you should consult your system and adapter guides to operations to see how to check and change the settings.

POWER MANAGEMENT

Q: I want to install OS/2 on a laptop. How does OS/2 manage power when I'm running on a battery?

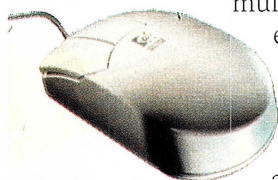
A: In addition to the Basic Input/Output System (BIOS) on a PC, a new standard has evolved for laptop systems, called the Advanced Power Management (APM) BIOS. APM consists of a set of standard interfaces for programs to communicate with and manage the power systems in the computer. APM is usually installed on but is not limited to laptop systems.

Power Management *cont'd on page 74*

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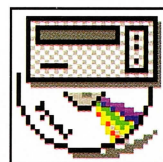
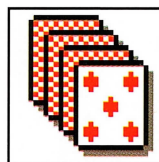
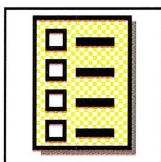
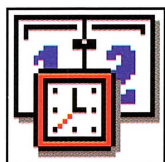
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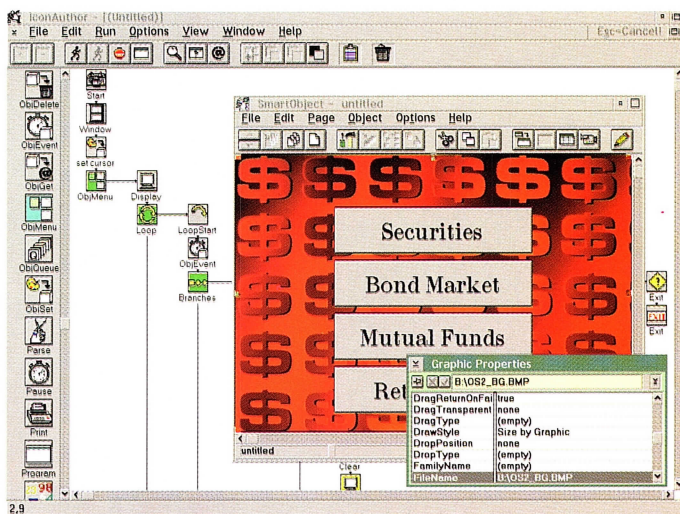


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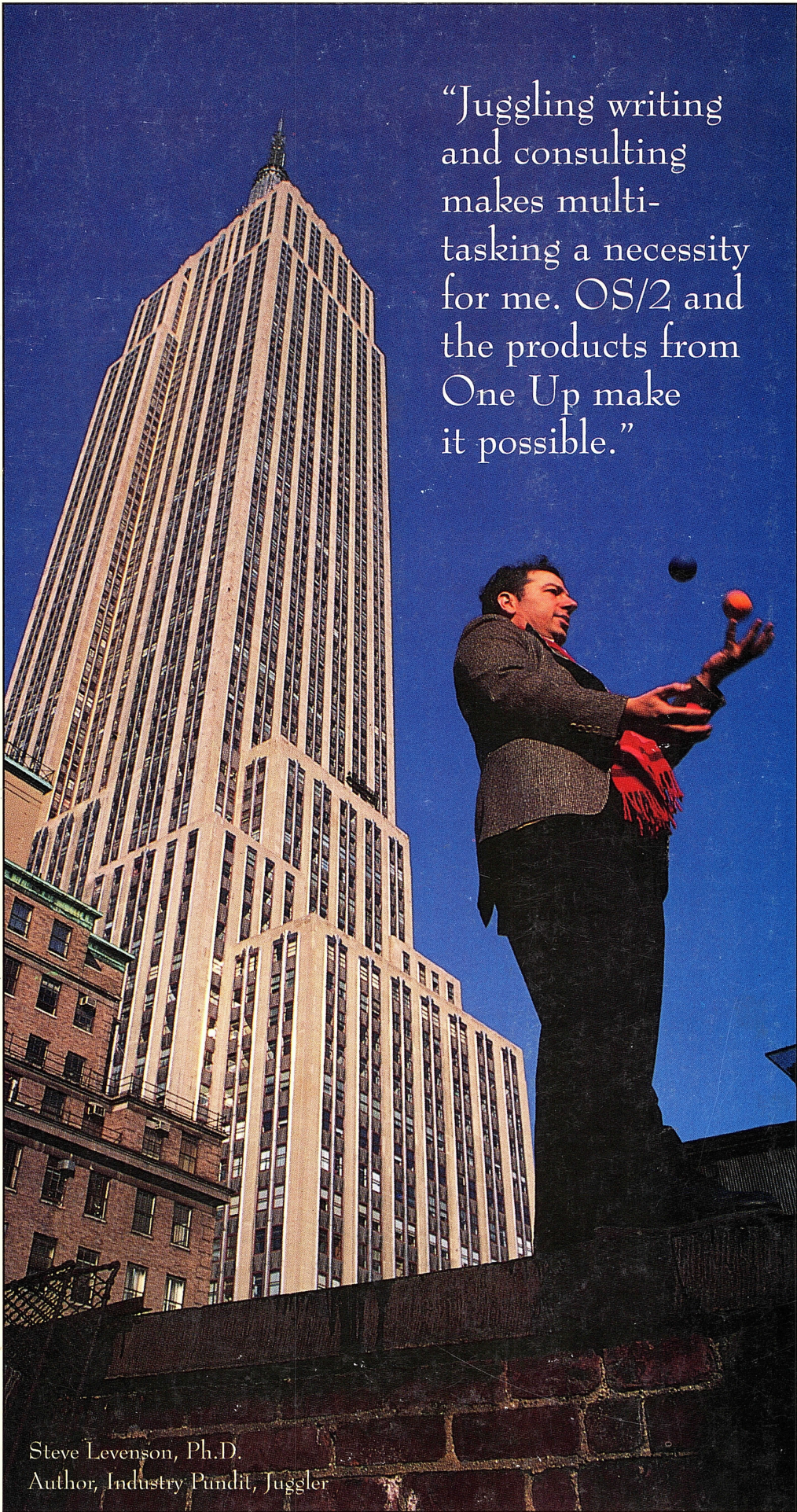
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